

AUSTRALIAN MUSEUM SCIENTIFIC PUBLICATIONS

Waite, E. R., 1897. The mammals, reptiles, and fishes of Funafuti. VIII. The mammals, reptiles, and fishes. *Australian Museum Memoir* 3(3): 165–202, plate viii. [12 July 1897].

doi:10.3853/j.0067-1967.3.1897.494

ISSN 0067-1967

Published by the Australian Museum, Sydney

nature culture **discover**

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THE MAMMALS, REPTILES, AND FISHES
OF FUNAFUTI.

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[VIII.]

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[Plate VIII.]

EXCLUDING the Birds, the indigenous terrestrial Vertebrate fauna of the Funafuti Atoll appears to be comprised in five species :— a rat and four lizards. Introduced, are the European rat and mouse, of which, however, examples were not obtained for certain identification ; and, as domestic animals, the pig and cat.

Dogs, now unknown on the Atoll, were at one time common, but were purposely exterminated, the reason, according to Moss, being as follows* :—“ At Funafuti the Turimen march round the village during the night, and quietly steal into the houses to see if all is right. It was found that the house dogs barked and gave notice of their approach, so they forthwith decreed the destruction of all dogs on the island and again became masters of the situation.”

Of marine animals, we are told that “ Porpoises ” are common off the coast at certain periods, † and that a turtle is also occasionally obtained ; Bats, Crocodiles, Ophidians, and Batrachians are unknown.

There being no fresh water on the Atoll beyond what the inhabitants can obtain by artificially arresting the rainfall, the Fish fauna is represented only by marine forms. Of these a fair number was collected, and indirect evidence respecting a few others is noted in the accompanying list.

MAMMALS.

Much of the literature of the Pacific Islands contains some mention of a native rat, described as living in the bush or infesting the houses and feeding upon vegetables and fruit, but for the

* Moss—Through Atolls and Islands in the Great South Sea, 1889, p. 118.

† See p. 67, “ General Account.”

most part no scientific description of the animal is attempted, nor is reference made to previous records in other islands. Although the rat is frequently mentioned, it has not in all cases been thought of sufficient interest to be indexed, and therefore many possible records are not apparent. The geographical distribution of the Pacific rat is so wide, and therefore of such interest, that I have thought it wise to include all definite localities met with during casual reading, to form a basis on which to build.

Before doing so, however, some notice of its identity is necessary.

IDENTITY.

Apart from the Maori rat, the only technical notice appears to be that by Peale,^{18*} who named (and figured) rats obtained from widely separated islands as *Mus exulans*. In this connection it may be mentioned that the Editor of the second edition of the work cited, remarks that he is not without suspicion that the animal is either *Mus pencillatus*, Gould,† or *Mus jacobæ*, Waterh.‡ There is, however, small likelihood of the Pacific rat being identical with either of these species, and indeed Thomas,²² by adopting Peale's name, has practically decided that it is distinct. His interesting note reads as follows:—

“The Rats from Sunday Island, Kermadec group, apparently belong to a species widely spread over the Pacific, the earliest name of which seems to be *Mus exulans*, Peale, based on Fijian examples. It is possible that examples from the different groups of islands may hereafter show certain differences from each other, but, so far as we can see at present, all should be united under one heading. Indeed the fine Maori Rat of New Zealand (*Mus maorium*, Hutton) seems to be very doubtfully separable from the same form, which has probably travelled from island to island in native canoes, or on floating logs &c., long before European ships began to bring over the ubiquitous Grey and Black Rats, which now threaten to exterminate the native species throughout the world.”

It will be remarked that Fiji is not included in the localities enumerated by Peale at which *Mus exulans* was obtained: for rats from this group that writer proposed another name—*Mus vitiensis*; there can be little doubt, however, that notwithstanding the slight differences mentioned, the two forms are not specifically distinct.

* A List of Works referred to will be found on p. 177.

† Gould—Proc. Zool. Soc., 1842, p. 12.

‡ Waterhouse—Voy. “Beagle,” Mam., 1840, p. 34.

All circumstances being taken into account, it appears probable that the Maori rat is also identical with this widely distributed Pacific species, and in one of his papers Hutton¹³ has pointedly remarked:—"It will be interesting to compare these skulls with specimens of the black rat* from Polynesia, for they will probably be found to be identical." And again, writing on *Mus novae-zealandiae*, Buller, he adds¹⁴ "There can, I think, be no doubt that these rats belong to the Polynesian variety." More recently Thomas has also expressed doubts as to the specific identity of the Maori rat, in the note previously quoted, and as mentioned by Buller,⁵ who further remarks that there are specimens of this form in the British Museum from the Fiji Islands, Norfolk Island, and New Caledonia. This view is supported by Maori tradition as related by Hochstetter,¹² to the effect that:—"the Kumara, or sweet potato (*Convolvulus batata*), the taro (*Arum esculentum*), the calabash-plant *Hue* (*Lagenaria vulgaris*), the Karaki tree (*Corynocarpus levigata*), the rat *Kiore*, the *Pukeko* (*Porphyrio*), and the green parrot *Kakariki*, are said to have been imported from Hawaiki." This traditional ancestral home is considered by modern Ethnologists to be Savaii, one of the Samoan Islands.

The New Zealand rat has a literature to itself, which will be found mainly in Trans. and Proc. N.Z. Institute. This literature I have not attempted to epitomise, and have referred to it only for odd records of habits. There is apparently still room for research among the New Zealand rats. The *Kiore* rat is said to be extinct, the *Mus maorium* to swarm, *vide* Meeson,¹⁷ Rutland,¹⁹ etc.

DISTRIBUTION.

If, as seems probable, the rat from all the Pacific Islands is referable to *Mus exulans*, the range of the species is very great indeed. Considering the native interchange which has taken place between islands hundreds of miles apart for ages past, this is not so remarkable as would at first sight appear.

For a long distance in the West Pacific there runs an enormous chain of islands, extending in a semi-circular sweep from the Marshall Archipelago, north of the equator to the Austral or Tubai Islands in the south-east. Our colleague has written of this as the Marshall-Austral chain, and dealt with it more particularly in his report.†

From each of the main links of this long chain of islands, we possess records of the occurrence of a native rat, as below enumerated.

* Our examples and also all other accounts agree in describing the colour of the Pacific rat as being similar to that of *Mus decumanus*, and not black as above indicated.

† See p. 3, "General Account."

Wake Island, an isolated atoll, which I would regard as an extension of the chain, is recorded by Peale,¹⁸ and is at the same time the most northerly and westerly (with New Caledonia) rat-inhabited island of which I have notice. Passing southward and westward the rat next appears to have been observed at Odia in the Marshall Group, and is represented by Kotzebue¹⁵ in an illustration as impudently trespassing in a Marshall Island house.

Continuing the chain, the rat is recorded from the Gilbert Group by Woodford,²⁵ who remarks that the only wild mammal he met with was a small species of rat common to the islands "in this part of the world."

The next group is that of the Ellice, of which the island of Funafuti at least, is tenanted, and supplied the examples, to be more fully described, and which prompted the present essay.

Mention has previously been made of Savaii being the traditional ancestral home of the Maori rat, but further evidence of its occurrence in Samoa is indicated by the reference to it in ancient tradition detailed by Turner,²³ and direct evidence is afforded²⁴ by this writer in the following note:—"The only indigenous quadruped is a small rat, something between a mouse and the Norwegian rat, the latter of which was introduced some years ago."

The last in the direct chain to which I have reference to the rat is the Cook Group, its occurrence being mentioned at Karatonga and Mangaia by Gill,^{9 & 10}

Of localities to the east of the main chain the following have been published. In the Phœnix Group Peale¹⁸ records it from Hull Island, and Arundel² from Sydney Island. Much further to the east it has been met with by Dixon⁷ at Malden Island, and also further to the south by Lamont, as quoted by Smith²¹ at Penhryn Island, and Dixon⁸ at Caroline Island, all isolated atolls. In the Paumotu Group or Low Archipelago Peale again records it from Disappointment and Dog Islands, and also from the Society Islands, remarking that the species was seen on but one "high" island, Tahiti.

Its north-eastern limit is suggested by a statement by Brigham³ that "Rats and mice have always been a pest on the Hawaiian Islands; and the old Hawaiian, before the introduction of cats, used a bow and arrows to destroy them. It is curious that knowing the principle of the bow they never used it as a weapon of offence, nor developed it beyond a very feeble instrument only suited to the killing of 'rats and mice and such small deer.'"

To the westward of the main chain Allardyce¹ records it from Rotumah, and it is once more mentioned by Peale from Fiji as *Mus vitiensis*, and from Hoonga in the Tonga Islands by

Mariner.¹⁶ The occurrence of a rat in the Kermadec Islands was first recorded by Smith,²⁰ who wrote:—"The only animal native to the island is a small grey rat, which is very plentiful in summer, but is supposed to hibernate during the winter. We saw one that had been partly eaten—by a hawk probably,—it was about five inches long." Thomas also received it from Sunday Island in this group, as already quoted. Away to the west it appears in New Caledonia, and again at Norfolk Island on the authority of Buller,⁵ who states that there are specimens in the British Museum from these localities.

The list of localities is closed by the inclusion of New Zealand as the most southern limit, and to which previous mention has been made in notices by Hutton, Thomas, Hochstetter, and others.

Although a systematic search of the literature of the Pacific Islands would doubtless disclose many more references to the rat, the above are the only definite localities I have so far met with. There is little doubt that the rat exists, or rather did exist, at one time or another on all the islands of the Pacific. Gill⁹ writing in 1876, and mentioning the islands of the South Seas as being inhabited by dogs, hogs, and rats, says:—"The rat alone is universal."

Arundel,² who called at many of the atolls in the Central Pacific, states:—"I have never visited an island, however small or barren, without finding these animals living upon it."

HABITS.

Unlike its European relative, the Pacific rat is usually said to feed only on vegetable substances. Writing of Mangaia, in the Cook Group, Gill⁹ states that it feeds exclusively upon cocoanuts, bananas, arrowroot, candle nuts, and papao (pawpaw) apples, and that it was usual to defend growing cocoanuts from the depredations of the native rat by making a sort of screen cleverly secured all round the tree, close to the fronds at a great height from the ground. In Mariner's¹⁶ book the rats are described as living chiefly upon such vegetable substances as sugar cane, bread fruit, etc., and it is incidentally mentioned that roasted cocoanut was used as a bait.

Peale¹⁸ adds the Pandanus to this list, and states that the fruit of this plant forms the principal food of the rat, hazarding the suggestion that if its appetite was at all carnivorous it would be found to feed upon the land crabs and molluscs on the shore, such however not being the case. He describes it (*Mus vitiensis*) as attacking pockets and packs containing edibles.

The Kiore Maori is described by Dieffenbach⁶ and others as being a frugivorous rat.

Rutland¹⁹ writes of the New Zealand bush-rat :—“ Considering the vast numbers of these rats that periodically congregate round the homes of settlers in the bush, the mischief done by them is extremely small. This is owing to their food during the time being green vegetables. In kitchen gardens they are certainly annoying, devouring peas, beans, cabbages, and even onions, as they appear above ground, climbing up poles to nip off the shoots of the vines, etc.”

Of Sydney Island Arundel² ascribes a partial animal diet to them, writing :—“ Before any settlements are formed they live in the ground and roots of trees, and subsist on young birds, birds' eggs, seeds, etc. As soon, however, as anyone comes to live on an island they gather round the settlement, particularly round the native quarters, natives being, as a rule, rather wasteful in their eating, and scattering round about them rice, bread, pieces of fish, etc.”

If the native rat preceded the human inhabitants of the atolls, the pandanus, being indigenous, would probably be its staple food, and as the coconut, breadfruit, arrowroot, etc., were introduced, the rat would acquire a taste for these articles.

As to its nesting habits the accounts are somewhat varied, Peale describes it as constructing a nest in the tussocks of grass, and making shallow burrows like an *Arvicola*. He describes *Mus vitiensis* as being a great pest in most of the houses of the Fiji Islands, making its nest in the thatched roof. Being an excellent climber it sallies forth at night in such numbers as to be exceedingly troublesome. Gill⁹ relates an instance of a pair having made a nest within a mummy conserved in a cave.

Of Caroline Island Dixon⁸ writes :—“ The brown rat has a foot-hold, but is not numerous. Their nests were made in the coconut trees, just at the base of the fronds.” Our colleague understood that it nested in similar situations in Funafuti.

In New Zealand, too, Rutland¹⁹ records how nests, evidently of rats, were found in the crowns of tree ferns and also under the roots of trees and among rushes. This writer describes the rats as being awkward on the ground but extremely active when climbing trees, ascending with the nimbleness of flies and running out to the very extremities of the branches. Hence, he adds, “ when pursued they invariably make to trees if any are within reach.” Peale mentions a similar habit in connection with the rats recorded by him.

In Tonga, Mariner¹⁶ describes it as being an inhabitant of the bush, writing :—“ Every now and then the natives make a peculiar noise with the lips, like the squeaking of a rat, which frequently brings them out of the bushes.”

In Mangaia, as mentioned by Gill,⁹ and as previously recorded, rats inhabited the mountain fern, whence they were occasionally

driven by fire. Arundel² describes the rats of Sydney Island as naturally living in the ground and roots of trees, but gathering round the dwellings as soon as a settlement is formed.

As elsewhere, the great enemy of the native rat is the common brown rat of Europe, introduced by ships throughout the world. Its depredations are such that Gill states that in many of the islands the indigenous breed has been exterminated by the imported rat. Some idea of the successful war waged by the introduced rat may be gathered from the following graphic account by the same writer⁹:—"In 1852 a solitary male Norway rat got ashore at Mangaia from the wreck of an American whaler. It made war upon the native rat, so that one of the bedrooms of the mission-house became uninhabitable. On removing the flooring about thirty dead native rats were found. We caught the offender in a trap."

Writing of Raratonga, another island of the Cook Group, the same author¹¹ incidentally records how the native rat has been subjected to even more deadly onslaught, being almost exterminated by the domestic cats which, originally introduced by missionaries and afterwards emigrating to the bush, took to hunting birds when rats became scarce.

On p. 59 of the present Memoir we read:—"Cats have long been introduced, they are known to the natives by the name of 'pussy,' and have proved of service in destroying the brown rat, formerly a great pest to the Islands." Dieffenbach,⁶ writing on New Zealand, states that the cat often runs wild and is another cause of the extermination of indigenous animals.

The natives themselves destroy the rats: first, as vermin; second, shooting them for sport; third, killing them for food.

When unchecked, rats became very numerous on some of the islands. Writing of Sydney Island, Arundel² mentions how on moonlight nights he has often seen hundreds of rats gathered together round the native quarters feeding upon waste rice, bread, pieces of fish, etc., thrown out. He adds that they frequently caught one hundred a night in tubs made into traps in the store.

In Mangaia they were also numerous, for Gill⁹ states that, like most of the Pacific Islands, it was literally overrun with rats, and describes how a large bottle-shaped hole was dug in the earth and baited with candle-nuts, adding that when the hole was pretty well filled with rats, two men would go down with knobbed sticks to kill them. A hole which would contain two men would accommodate a goodly number of rats! If the Mangaian rats were equally vicious with those mentioned by Peale, rat-killing under such conditions would not be unattended by danger, for he states that the animal resists pertinaciously and bites severely.

The reduction in the number of rats was a matter of such importance with the inhabitants, that we find a number of ingenious traps were in use for the purpose ; these will be treated of in the Ethnological Report.

We have mentioned that sport may constitute a second way in which the rat is subject to persecution by the natives, Mariner¹⁶ has given an exhaustive account of the sport of "fanna gooma" or rat shooting, as practised on the island of Hoonga in the Tonga Group, from which it appears that it was an amusement in which only chiefs were permitted to participate, and was undertaken with much ceremony. The rats attracted by bait previously distributed, were shot with unfeathered arrows six feet long, projected from bows of similar length. The game was a party and not an individual affair, the party first killing ten rats was accounted the winner. If, Mariner adds, there be plenty of rats, they generally play three or four games. For a full account of the rules of the game the reader is referred to Mariner's book, which contains much of interest about the Tonga Islands. In Honolulu, as mentioned by Brigham,³ the bow was exclusively devoted to "killing rats and mice and such small deer."

The third reason for the native destruction of rats is of greater interest, and may be more fully mentioned.

In many of the islands of the Pacific the native rat formed an article of food with the inhabitants ; feeding upon fruit or vegetables it would be less objectionable than the omnivorous European rat, and indeed Buller⁴ remarks that :—"Unlike the common rat, the rat of New Zealand is perfectly free from odour of any kind, probably due to the nature of its food, this consisting almost entirely of fruits and berries." The introduced rats were nowhere eaten : it may be that they were considered to be unpalatable, but it is equally possible that at the time they obtained a footing on the islands, pigs and other edible animals would also be introduced, and the necessity of eating rats removed. These native rats must have been considered good eating, for Gill,⁹ writing on the Cook Islands, states :—"The proverb 'sweet as a rat' survives in Mangaia to this day, although the adults of this generation have given up the disgusting practice of rat-eating."

This prolific and entertaining writer¹⁰ has given a valuable historical account of the capture and cooking of rats as practiced in Mangaia : it may be epitomised as follows :—

"In those days—ere the cat had been introduced—rats were very plentiful. Rat-hunting was the grave employment of bearded men, the flesh being regarded as most delicious. The rat, though but slightly larger than the English mouse, was the only quadruped on the island.

“Tamangoru, a solitary cannibal, on one occasion discovered two boys roasting a number of rats over a fire,—a joyful sight for a famishing Mangaian, he ambiguously remarked, ‘cooked rats are capital eating.’ The word ‘rats’ thus used might apply to the lads as well as to the little quadrupeds. A cooked boy would be indifferently called a ‘fish’ or a ‘rat.’

“These two brothers subsisted chiefly by rat-catching, in which they were adepts.

“On the previous evening they dug a deep hole in the earth and covered the bottom of it with candlenuts, of which rats are excessively fond. A narrow pathway was made on either side for the rats to get down and eat. The lads lay in wait at a little distance, until they thought that the hole must be pretty full. Each lad carried a lighted torch in one hand, and a stout iron-wood stick in the other. They quickly killed a large number of rats.

“The boys now made a fire to roast the spoil. They then thrust long green reeds (previously prepared) through the rats, eight on each reed, and grilled them over the fire. There were four skewers or reeds of rats, that is, thirty-two in all. When the rats were done, the elder took two reeds of rats (sixteen) to Tamangoru; the famished man greedily devoured them and called for the remaining two reeds.”

The same author⁹ informs us that in the neighbouring island of Raratonga, rats were not eaten, the inhabitants reviling the natives of Mangaia as the rat-eating Mangaians.

It would, however, appear that rats were not eaten when fish was procurable, for Gill relates how, when the sea was too rough for fishing, the boys set fire to the mountain fern, so that the rats rushing out of the fern, half blinded with fire and smoke, were easily killed with long sticks.

In Tonga (Hoonga Island) the rats formed an article of food with the lower orders of people, but in the account above referred to, Mariner¹⁶ says they are not allowed to make a sport of shooting them, this privilege being reserved for “chiefs, mata-booles, and mooas.”

Of the rat in New Zealand, Dieffenbach⁶ tells us that the frugivorous Kiore Maori was formerly largely eaten by the natives, but that it had in 1843 become so scarce, owing to the extermination carried on against it by the European rat, that he could never obtain one.

Buller⁴ describes how during certain seasons the New Zealand rat was captured by thousands and eaten, or potted down in their own fat for future use.

At Penhryn Island, Smith²¹ informs us that the only animal on the atoll was a small rat, which was not eaten.

In Funafuti the native rat is described to me as having been driven from the village, and indeed almost exterminated upon the main islet by the foreign rat. Upon the other islets it exists and in some cases swarms, but as these islets are not permanently tenanted the rat can scarcely be regarded as a pest.

It constructs its nest in the cocoanut trees, just at the base of the fronds, and Mr. Hedley tells me that he frequently noticed the rats peeping out of the matting that sheathes the butts of the cocoanut fronds, and scampering about the heads of palms, fifteen or twenty feet high. In pre-civilised times these rats were a great plague to the natives, who did not use them as food. By law each individual was at times obliged to catch and destroy a set number of these vermin, for which purpose an ingenious trap was used.

NATIVE RAT.

MUS EXULANS, Peale.

Mus exulans, Peale, U.S. Expl. Exp., Mamm., 1st Ed., 1848, p. 47.

(Plate viii., figs. 1a-f.)

Fur fine, scanty, and of medium length; colour warm brown, reddish on the nape and back, basal half of the hair delicate grey, the tips yellowish or brown. On the back the fur is mixed with longer and comparatively thick hairs of bristly texture, these are white or very pale yellow throughout their length, the extreme tip only being dark brown. Muzzle and face warm brown; the hairs on the sides of the body are tipped with pale yellow with no longer or darker hairs intermixed. The whole under surface including the inside of the limbs white, fur pale grey at the base. Ears rounded and of considerable breadth, but on being laid forward they do not reach the eye. Outside of limbs coloured like the back; on the hind foot the colour extends scarcely further than the heel leaving nearly all the foot white. Foot and claw-pads very large. Tail longer than the head and body, quite rat-like. Hairs longer than the scales, but not so long as two scales, excepting towards the tip which is inclined to be pencilled. Scales $9\frac{1}{2}$ to the centimeter; mammae $2\cdot2=8$.

Skull of delicate proportions; the nasals project considerably beyond the line of the premaxillary; supraorbital ridge thin but very prominent, it becomes lower in the temporal region and is little more than discernable above the aural aperture: condition of occipital region unknown. The anterior palatina foramina are somewhat broad and reach the anterior margin of the molar alveoli. The anterior zygoma root is rounded above and the front edge scarcely emarginate.

Teeth.—The teeth do not call for special reference, the character of the molar pattern being sufficiently represented on the accompanying plate (fig. 1*d*).

| | <i>Dimensions.</i> | | | | Millim. |
|--------------------------------|--------------------|-----|-----|-----|---------|
| Head and body | ... | ... | ... | ... | 125·0 |
| Tail ... | ... | ... | ... | ... | 148·0 |
| Length of head | ... | ... | ... | ... | 37·5 |
| Muzzle to ear | ... | ... | ... | ... | 30·0 |
| Ear ... | ... | ... | ... | ... | 17·5 |
| Forearm and hand | ... | ... | ... | ... | 35·0 |
| Hind foot | ... | ... | ... | ... | 28·0 |
| Heel to front of last foot-pad | ... | ... | ... | ... | 13·7 |
| Last foot pad | ... | ... | ... | ... | 5·0 |

| | <i>Skull.</i> | | | | |
|-------------------------------|---------------|-----|------|-----|------|
| Greatest length | ... | ? | 35·0 | ... | ? |
| Basal length... | ... | ... | 30·0 | ... | ? |
| Greatest breadth | ... | ... | 17·6 | ... | ? |
| Nasals, length | ... | ... | 14·0 | ... | 14·5 |
| Nasals, greatest breadth | ... | ... | 4·0 | ... | 4·1 |
| Interorbital breadth | ... | ... | 5·5 | ... | ? |
| Interparietal length | ... | ... | 4·7 | ... | ? |
| Interparietal breadth | ... | ... | 10·0 | ... | ? |
| Brain-case, breadth... | ... | ... | 13·6 | ... | ? |
| Anterior zygoma root | ... | ... | 3·5 | ... | 3·8 |
| Diastema ... | ... | ... | 9·0 | ... | 9·8 |
| Palate, length | ... | ... | 18·4 | ... | ? |
| Anterior palatina foramina... | ... | ... | 5·7 | ... | 6·0 |
| Upper molars, length | ... | ... | 5·7 | ... | 6·2 |
| Lower molars, length | ... | ... | 6·0 | ... | ? |
| Condyle to incisor tip | ... | ? | 23·0 | ... | ? |
| Coronoid tip to angle | ... | ... | 9·2 | ... | ? |

Peale¹⁸ states that in his examples "the females have two pectoral and four abdominal teats," whereas in mine the pectorals are four. This may be reconciled by supposing that Peale overlooked a pair of mammæ, an error, as I have in a former article indicated, easily committed.

Three examples of the Funafuti native rat were included in the collection: two of these I had not the opportunity of examining. The third had the skull a little but not very seriously damaged, and fragments of a fourth specimen enabled me to add the few figures in the second column of skull dimensions.

The stomach of the rat examined contained a white vegetable substance, possibly cocoanut or pandanus.

On the Funafuti Atoll this rat is known to the inhabitants by the name of "Tikimoa."

The Pacific Ocean being bounded by the land masses of Asia, Australia, South and North America, and the genus *Mus* being exclusively confined to the Old World, it necessarily follows that this rat has entered the islands of the Pacific from an Asiatic source. This agrees with the origin of the flora of the region as sketched by Guppy,* and also with the distribution of the Lepidoptera independently remarked by Woodford.† It is thus opposed to the theory of a migration westward from America across a Mesozoic Pacific continent as advocated by Hutton.‡

POSTSCRIPT.

As previously indicated, it only needs more extensive reading to add materially to the known distribution of the Pacific rat, and already several localities may be added to those enumerated. A perusal of Brenchley, "Cruise of the Curaçoa,"^{2a} shows that it has been observed at Niue or Savage Island, situated between the Samoan and Cook Groups, and again at Aneitium, Tanna, and Efate, in the New Hebrides. It is also said to be indigenous to Upolu and Tutuila in the Samoan Islands, being at the latter place described as "the mouse." At Tongatabu the rat is said to be imported.

It may be mentioned that the only group in the South Pacific from which I have not quoted references is the Marquesas; an hiatus which would doubtless be filled did time permit to search its literature.

* Guppy—Trans. Vic. Inst., 1896. (Reprinted on p. 20 of the "General Account.")

† Woodford—Geogr. Journ., vi., 1895, pp. 349-350; also *ante*, p. 90.

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NATIVE RAT.

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23. Turner, George—Samoa, 1884, pp. 25, 187, 216, 218.
24. Turner, George—Scot. Geogr. Mag., v., 1889, p. 246.
25. Woodford, C. M.—The Gilbert Islands, Geogr. Journ., vi., 1895, pp. 347-9.

REPTILES.

The only turtle found in the neighbourhood of the Atoll is *Chelone mydas*, and this was regarded as by no means common. Further notice of the green turtle will be found in the introductory article (pp. 65-7), and Mr. Hedley asks me to insert the following references which he found after the preceding pages had been printed:—

As stated on p. 66, turtles were sacred animals in Polynesia, only eaten after certain ceremonies. One of the best descriptions of these we owe to Lamont,* who writes of Penrhyn Island:—

“The following day, to my surprise, we were again all marshalled and marched to the sea shore, where I found a turtle sprawling on its back. After some words were repeated over it by one of the priests who had officiated at the mara, Turua stepped forward to the edge of the water, and, in a menacing attitude, seemed to denounce someone, throwing up his arms, and vociferating at the top of his voice, as if threatening an imaginary being at sea. The turtle (or ‘hona,’ as they call it) had, it appeared, a spirit in it, which, being driven out by one of the priests, was threatened with vengeance by the bold warrior if he attempted to return. The unfortunate turtle was at once conveyed to a mara, different from the one we had visited the previous day, and after a few ceremonies was beheaded and disembowelled. A large fire was then prepared on an elevation of stones, and it was sacrificed to the gods. On our return to the gravel plot, where the people had again all assembled, a mat was placed in the centre for me, and the cooked turtle, cut into small pieces, was served up in the shell, in which it had been roasted. Monitu, Taharua, and Turua sat at a respectful distance on the mat, the rest of the people forming an extensive circle somewhat further off. My three privileged friends, diving their hands into the meat, selected the most tempting pieces, with which they endeavoured to feed me. This I rather declined, and was allowed to help myself. As they looked, at every mouthful I took, like hungry dogs, I offered one or the other a piece, which was laughingly accepted and devoured, my generosity being received with flattering comments from the circle. Extending my liberality I threw some pieces to Ocura and Mau Kakara, when, to my astonishment, the women jumped up and fled in terror, shouting ‘Huie atua!’ Taharua and Turua held my hands, and shaking their heads, gravely repeated the same words, but Monitu only laughed heartily at my mistake.”

* Lamont—Wild Life among the Pacific Islanders, 1867, p. 182.

The natives of Futuna likewise made the slaughter of a turtle an occasion of great ceremony.* By the people of Rotuma it was held in like regard.†

No sea snakes were heard of, and were apparently unknown to the islanders. The terrestrial Reptilian fauna is represented by the four Lacertilians below mentioned, which were the only members of the order included in the collection.

Mr. Hedley informs me that specimens of the geckos could at any time be secured by pulling back the pinnæ of young palms; the little creature was snugly ensconced between the base of the leaves, expanded to embrace the stem and the trunk. A search of half-a-dozen palms rarely failed to reveal one or more specimens.

The skinks afforded sport to the children, who fished for them with hook and thread among the broken undergrowth of the island: they were exceedingly numerous and could be found almost everywhere.

Mr. C. M. Woodford, in the course of some interesting remarks upon the transference, by human agency, of these reptiles from island to island, observes‡:—"It is the rule rather than the exception for one or more lizards to be unwilling passengers when one of the large native canoes is at any time put into the water. On one voyage from the Solomons to Australia I remember that a lizard frequented the foretop for several days; and on two occasions when bringing orchids to Sydney from the Solomons, I have, on opening the case, found a living gecko among the plants. They are easily brought on board ship among the firewood, and their presence, therefore, even upon remote islands, supposing that they are occasionally visited by ships, presents little difficulty."

FAMILY GECKONIDÆ.

GYMNODACTYLUS, *Spix.*

GYMNODACTYLUS PELAGICUS, *Girard.*

Gymnodactylus pelagicus, Girard, sp., Proc. Acad. Nat. Sci. Phil., 1857, p. 197; Günther, Voy. "Curaçoa," p. 404, pl. xxiv, fig. a.

This species, so widely distributed in the islands of the Pacific, is represented by specimens which differ slightly from the descriptions of the species. The dorsal tubercles are not so closely set as shown in Günther's figure, but are separated by two or three

* Smith—Journ. Polyn. Soc., i., 1892, p. 41.

† Allardyce, G. W. L.—Proc. and Trans. R. Geogr. Soc. Austr., Qd., i., 1886, p. 142.

‡ Woodford—Geogr. Journ., vi., 1895, p. 349.

tubercles. Those on the hind limb are arranged in rows almost as regular as those of the back. The specimens do not exhibit tubercles on the tail as found in some examples, and as the markings are similar to those on the body it does not appear that the member has been reproduced.

GEHYRA, *Gray.*

GEHYRA OCEANICA, *Lesson.*

Gehyra oceanica, Lesson, sp., Voy. "Coquille," Zool., ii., p. 42, pl. ii., fig. 3.

The specimens collected do not in any way differ from those obtained in the other Polynesian Islands, throughout which the species is widely distributed.

FAMILY SCINCIDÆ.

LYGOSOMA (EMOA), *Gray.*

LYGOSOMA CYANURUM, *Lesson.*

Lygosoma cyanurum, Lesson, sp., Voy. "Coquille," Zool., ii., p. 49, pl. iv., fig. 2.

The phrase* "four labials anterior to the large subocular" should read "four or five labials," etc., in order to receive the examples from Funafuti which do not otherwise differ from specimens received from elsewhere.

LYGOSOMA ADSPERSUM, *Steindachner.*

Lygosoma adpersum, Steindachner, sp., Sitz. K. Akad. Wiss. Wien., lxii., 1870, pl. iv., fig. 1.

This species, apparently the least widely known of the four Lacertilians received, is very common on the Funafuti Atoll. Eggs were obtained; they are very nearly spherical, their greatest diameter measuring 13 millim., and their least diameter 12 millim.

Finsch has recorded † four Lacertilians from the Gilbert Group, two of which only are identical with ours. He enumerates the following:—*Gehyra oceanica*, *Platydactylus* (*Lepidodactylus*) *lugubris*, *Mabouia* (*Lygosoma*) *cyanura*, and *Ablepharus pæcilo-pleurus* (*A. boutonii*).

* Brit. Mus. Cat. Lizards, iii., 1887, p. 290.

† Ann. K.K. Naturhist. Hofmus., viii., 1893, p. 21.

FISHES.

The Collection of Fishes comprises fifty-four species, which are for the most part well known forms. A large number of them are widely distributed, and range from the Red Sea and the east coast of Africa across the Indian and Java Seas to Polynesia. Smaller and possibly more interesting species were not obtained, due to the only possible method of procuring them. The natives brought in the fishes as caught by net or hook, and not conceiving that they were required for other than edible purposes, naturally preserved only the best examples from their point of view. At first they very sedulously avoided bringing to land any specimens they regarded as poisonous, and it was some time before they could be made to understand that the fishes were not to be eaten.

Zoologically this notice is little more than a list, which is of value more especially for extending the known range, and by supplying an exact locality for the species enumerated.

Some of the short notes may be of wider interest, and this refers especially to the native names which have an Ethnological value.

All the specimens have been referred to described species, but in a few instances the identification is doubtful, due to insufficient descriptions, the fugitive nature of the characters described, or to the necessary literature not being accessible.

SERRANIDÆ.

EPINEPHELUS, *Bloch.*EPINEPHELUS URODELUS, *Cuv. & Val.*

Epinephelus urodelus, Cuv. & Val., sp., Hist. Nat., ii., p. 306 ;
Günther, Fische der Südsee, p. 3, pl. iii., fig. *a*.

This brilliantly coloured "rock-cod" is called "Matiri" by the natives, and the only example obtained is of the variety with the white convergent lines on the tail.

EPINEPHELUS LEOPARDUS, *Lacépède.*

Epinephelus leopardus Lacépède, sp., Poiss., iii., p. 517, pl. xxx.,
fig. 1 ; Günther, Fische der Südsee, p. 4, pl. iii., fig. *b*.

Although many of the Serranidæ are nearly allied, I have no doubt that the only specimen available is correctly assigned to the present species. In addition to its comparative proportions it agrees well with Günther's figure, the black band on the upper lobe of the tail is however alone developed.

EPINEPHELUS TAUVINA, *Forsk.*

Epinephelus tauvina, *Forsk.*, sp., *Descr. Anim.*, p. 39 ; *Bleeker, Atlas Ichth.*, pl. cclxxxiii., fig. 1.

Greatly esteemed as food on the island and fished for with hook and line, both within the lagoon and from the outer reefs. In the absence of a good series (having only one example) I cannot be certain of the identification, its characters, however, agree most nearly with the descriptions of this widely distributed Indo-Pacific species. It is evidently a young fish, measuring only 272 millim.

The native name is "Mou."

EPINEPHELUS MERRA, *Bloch.*

Epinephelus merra, *Bloch.*, *Ausl. Fische*, vii., p. 17, pl. cccxxix. ; *Günther, Fische der Südsee*, p. 7, pl. vii.

One example of the typical form, namely no white spots on the body, and the pectorals with round black spots. This species so far as could be ascertained did not frequent the lagoon, at least it was not caught there, but Mr. Hedley hooked some off the outer reef, where they entered the crevasses and took the bait greedily. The natives, it appears, at the time of the Expedition, only fished the lagoon, all species from the reefs being indiscriminately condemned.

Quantities of pumice were recently washed on to the beach, and several of the inhabitants became ill and one died after eating fish caught from the reefs. As this was supposed to be in consequence of the presence of the pumice, the fish were condemned, but will again be utilised when the pumice ceases to be thrown up. This ban did not refer to fishes caught in the lagoon, which was free from pumice.

As pumice is a harmless substance, Mr. Hedley suggests that its occurrence was coincident with the arrival of some marine organism, which might vitiate the food supply of the fish, and thus indirectly have a harmful effect upon the natives.

In this connection Wyatt Gill writes* :—"On the outer edge of our coral reefs exists a sea-centipede (*Nereis*), in appearance like a black thread slowly moving amongst the rugged submarine growths. The *ae* attains the length of five or six feet. Good fish become poisonous through feeding on these sea-centipedes.

"Strangely enough, fish that are excellent eating on one island may be poisonous on another. Thus the dainty *matakiva* of Mangaia is poisonous on the neighbouring island of Mitiaro. A chief of that atoll, hearing that it is much prized in Mangaia,

* Gill—*Life in the Southern Isles*, 1876, p. 274.

concluded it was a mere fancy of his countrymen that it should be hurtful at Mitiaro. Accordingly, he ate one, and died a few hours afterwards."

The native name of this species is "Natala," and the size of the specimen preserved 198 millim.

LUTIANUS, *Bloch.*

LUTIANUS BENGALENSIS, *Bloch.*

Lutianus bengalensis, Bloch., sp., Fisch., pl. ccxlvi., fig. 2, Bl. Schn., p. 316; Temm. & Schleg., Fauna Japon. Poiss., pl. vi., fig. 2.

Attaining a length of ten inches this fish is a valuable source of food supply, and two names were obtained for it, namely "Savani" and "Tumti." After the large depopulation of the island of Funafuti by American slave traders, immigrants arrived from adjacent shores. Mr. Hedley therefore supposes that one of these names was imported from some neighbouring tribe.

A very young example of only 38 millim., and without doubt of this species, is, as is common with young forms, much more spiniferous than the adult. The preopercle is strongly denticulated, and is produced into a strong spine at the angle.

LUTIANUS GIBBUS, *Forsk.*

Lutianus gibbus, Forsk., sp., Descr. Anim., p. 46; Günther, Fische der Südsee, p. 12, pl. xii.

The native name "Teia" is identical with that recorded by Günther "Taea," as in use in the Society Islands. The specimen which has attained its adult colouration measures 270 millim.

LUTIANUS FULVIFLAMMA, *Forsk.*

Lutianus fulviflamma, Forsk., sp., Descr. Anim., p. 45; Bleeker, Atlas Ichth., pl. ccc., fig. 2.

The only specimen received serves to extend the known range of the species.

CHÆTODONTIDÆ.

CHÆTODON, *Cuvier.*

CHÆTODON AURIGA, *Forsk.*

Chaetodon auriga, Forsk., Descr. Anim., p. 60; Günther, Fische der Südsee, p. 36, pl. xxvi., fig. b.

Although the island of Funafuti should be a veritable home for Chætodons, Chelmos, Holacanth, etc., many of which were seen swimming in the crevasses, this is the only member of the

family obtained. As previously mentioned this is to be accounted for by the fact that only the larger species were, as a rule, collected by the natives. This *Chætodon* is of the variety *setifer*, and measures 114 millim. in length.

MULLIDÆ.

MULLOIDES, *Bleeker*.

9. MULLOIDES FLAVOLINEATUS, *Lacépède*.

Mulloides flavolineatus, Lacépède, sp., Poiss., iii., p. 406; Rüppell, N.W. Fische, p. 101, pl. xxvi., fig. 1.

This species is represented by a single example.

The Funafuti name is "Malili."

MULLOIDES SAMOENSIS, *Günther*.

Mulloides samoensis, Günther, Fische der Südsee, p. 57, pl. xliii., fig. b.

(Pl. viii., fig. 2 a-b.)

I have referred to this species a small specimen which measures only 76 millim. in total length, or less than half the dimensions of the type specimen: "6½ Zoll" (= 165 millim.). As the species was founded on a single example, and as it does not appear to have been met with since first described (1873), the following description will assist in verifying or disproving the determination:—

D. vii., I 8. V. I 5. A. II 6. L lat. 40 L tr 2½, 6.

Length of head 3·4, of caudal fin 5·0, height of body 4·2 in the length of the body (exclusive of the caudal fin). Diameter of eye 3·6, length of snout 2·4 in length of head; interorbital space very lowly arched 4·0 in length of head. Upper jaw the longer. The maxilla reaches two-thirds the distance to below the anterior edge of the orbit.

The barbels extend to slightly beyond the posterior edge of the preopercle. Upper profile from above the eye to the snout markedly convex. Opercle with a weak spine and a slight denticulation, indicative of a second spine above. Teeth in villiform bands in both jaws. First and second dorsal spines of equal length, 1·7 in the length of the head. Second dorsal two-thirds the height of the first. The anal commences slightly behind the second dorsal. The ventrals do not reach the vent by fully a third of their length; caudal deeply forked, the least height of its pedicle equals the intradorsal space.

Scales ctenoid, in five series between the dorsal fins. Tubes of the lateral line not much branched, consisting of two main arms

bifurcated anteriorly, but simple from below the second dorsal to the caudal.

Colours.—In formol, silvery white with a greenish tinge on the dorsal surface: the top of the head is yellowish, and the same colour is to be traced on the cheeks—there is a distinct yellow spot immediately above the opercular spine. Fins immaculate, excepting the caudal which, towards the base, is of yellowish hue. The black and pearl-coloured blotches mentioned by Günther are not to be observed in our example. The type specimen was obtained at Apia in the Samoa Islands, one of the archipelagos nearest to the Ellice Group.

UPENEUS, *Bleeker*.

UPENEUS TRIFASCIATUS, *Lacépède*.

Upeneus trifasciatus, Lacépède, sp., Poiss., iii., p. 104, pl. 15, fig. 1; Günther, *Fische der Südsee*, p. 59, pl. xlv., figs. b, c.

This widely distributed form is represented by a solitary example, in which the usual dark markings are almost obsolete, the body band beneath the second dorsal is the most pronounced, whilst the black mark on the basal half of this fin is the darkest feature of the specimen. It measures 173 millim.

The native name is "Teforo."

SPARIDÆ.

LETHRINUS, *Cuvier*.

LETHRINUS ROSTRATUS, *Cuv. & Val.*

Lethrinus rostratus, Cuv. & Val., sp., *Hist. Nat.*, vi., p. 296; Playfair, *Fishes of Zanzibar*, p. 44, pl. vii., fig. 2.

Said to be common and a favorite food-fish. When the more esteemed species are not caught in sufficient numbers, inferior kinds are eaten in consequence of the limited flesh-foods on the island. A small example only was brought to Sydney.

Known to the natives as "Nutta."

LETHRINUS RAMAK, *Forsk.*

Lathrinus ramak, Forsk., sp., *Descr. Anim.*, p. 52; Günther, *Fische der Südsee*, p. 64, pl. xlv., fig. 13.

The two yellow longitudinal bands which Günther remarks are such a striking feature in the living fish, are very conspicuous in two of our three examples. There is also a third fainter and

narrower band immediately below the lateral line, this is indicated in Günther's figure but is not referred to in the text. These specimens appear to be rather larger than any previously recorded, measuring 315, 307 and 287 millim. respectively.

The native name is "Gropa."

SPHÆRODON, Rüppell.

SPHÆRODON GRANDOCULIS, Forsk.

Sphærodon grandoculis, Forsk., sp., Descr. Anim., p. 53; Bleeker, Atlas Ichth., pl. cxcix., fig. 1.

Found widely distributed in the South Seas, and extending across the Indian Ocean to the Red Sea, this species is now recorded from the Ellice Group. The example examined totals a length of 312 millim. The figure referred to represents a young individual showing the white transverse body bands.

CIRRHITIDÆ.

CIRRHITES, Cuvier.

CIRRHITES MACULATUS, Lacépède.

Cirrhites maculatus, Lacépède, Poiss., sp., v., p. 3; Günther, Fische der Südsee, p. 71, pl. li., fig. a.

Readily distinguishable, in conjunction with other characters, by the smallness of the scales on the cheeks, the species is represented by two individuals, measuring 200 and 164 millim. respectively. This record is interesting, as the species does not appear to have been obtained from many of the Pacific Islands.

BERYCIDÆ.

HOLOCENTRUM, Artedi.

HOLOCENTRUM ERYTHRÆUM, Günther.

Holocentrum erythræum, Günther, sp., Cat. of Fishes, i., p. 32; Fische der Südsee, p. 99, pl. lxiii., fig. b.

The occurrence of this species in the Ellice Group adds one more definite locality to its known distribution. It has a wide range in the Southern Seas, but was not regarded as common in Funafuti, where it is known as "Malou." The single specimen obtained measures 200 millim. in total length.

HOLOCENTRUM DIPLOXIPHUS, *Günther*.

Holocentrum diploxiphus, Günther, Proc. Zool. Soc., 1871, p. 660, pl. lx.

This species is also known from several of the Polynesian Islands, and as Günther remarks, apparently remains of small size: the only example brought home measures 144 millim. in length.

It is called "Boutularu" on the island of Funafuti.

* TEUTHIDÆ.

TEUTHIS, *Linnaeus*.

TEUTHIS ROSTRATA, *Cuv. & Val.*

Teuthis rostrata, Cuv. & Val., Hist. Nat., x., p. 158; Playfair, Fishes of Zanzibar, p. 50, pl. x., fig. 2.

As the descriptions of the various species are for the most part little more than a notice of the colour-pattern, and as this usually fades on contact with spirit, the determination of the species cannot be satisfactory without a good series of the genus. Our two examples I determine as *Teuthis rostratus*, and a comparison with Playfair's description and figure largely removes any doubt as to their identity. Günther has identified the species from the Society, Pelew, and Gilbert Islands, so that its occurrence in Funafuti is merely an extension of the known range.

Known to the natives as "Mai'ava" or "Meia."

ACRONURIDÆ.

ACANTHURUS, *Bloch*.

ACANTHURUS TRIOSTEGUS, *Linn.*

Acanthurus triostegus, Linn., Syst. Nat., i., p. 463; Bennett, Fishes of Ceylon, p. 11., pl. xi.

One would scarcely expect to receive even a very small collection of fishes from the Pacific Islands without this ubiquitous species being included. Of three examples the largest measures 158, the smallest 54 millim.

The native name in Funafuti is "Manini," and its universal application is noteworthy. Günther remarks:—"Throughout the whole of Polynesia it is called 'Manini.'"

* For paper on the Teuthidoidea, see Gill, Proc. U.S. Nat. Mus., vii., 1885, p. 276.

ACANTHURUS GUTTATUS, *Forsk.*

Acanthurus guttatus, *Forsk.*, sp., *Descr. Anim.*, p. 218; *Günther*, *Fische der Südsee*, p. 109, pl. lxix., fig. a.

This species has also a wide range in the Pacific. We have two specimens from the atoll, measuring 208 and 190 millim respectively.

The native name is rendered as "Te api" or "Yappi," which is practically identical with "Hapi" in use in the Sandwich Islands, as recorded by *Günther*.

ACANTHURUS BLOCHII, *Cuv. & Val.*

Acanthurus blochii, *Cuv. & Val.*, *Hist. Nat.*, x., p. 209 (*vide Günther*); *Günther*, *Fische der Südsee*, p. 109, pl. lxix., fig. b.

Günther remarks that it is extremely doubtful whether *A. matoides*, *Klunz.*, from the Red Sea, is identical with the species he had hitherto so named. He therefore adopts the name *A. blochii*, which species is to be distinguished by the dorsal fin being lower in proportion to the height of the body. Our specimens quite agree in this respect, for the spines are $3\frac{1}{3}$, whereas in *Klunzinger's* species they are much longer, namely $2\frac{3}{4}$ in the height of the body.

ACANTHURUS ACHILLES, *Shaw.*

Acanthurus achilles, *Shaw*, *Zool.*, iv., p. 383; *Günther*, *Fische der Südsee*, p. 115, pl. lxxi., fig. b.

Several examples of this unmistakable and handsome species were brought from Funafuti, where they are known to the inhabitants as "Matto."

NASEUS, *Commer.*NASEUS LITURATUS, *Forsk.*

Naseus lituratus, *Forsk.*, sp., *Descr. Anim.*, p. 218; *Günther*, *Fische der Südsee*, p. 124, pl. lxxxii.

The natives appear to have associated this genus with the Acronuridae, for while *A. triostegus* is designated as "Manini," the present species is distinguished by a prefix, the rendering being "Rakomanini."

CARANGIDÆ.

CARANX *Lacépède.*CARANX MUROADSI, *Temm. & Schleg.*

Caranx muroadsi, Temm. & Schleg., Fauna Japon. Poiss., p. 108, pl. lviii., fig. 1.

While I cannot be absolutely certain of the correct determination of the species, the aggregate characters lead me to name the only specimen procured as above. *Caranx muroadsi* has not, so far as I am aware, been previously recorded from other than the seas of Japan, with Ternate doubtful. (Günther.) Length of specimen 295 millim.

CARANX CRUMENOPHTHALMUS, *Bloch.*

Caranx crumenophthalmus, Bloch., sp., Fisch., pl. cccxliii.; Jenyns, Voy. of "Beagle," Fish, p. 69, pl. xv.

This widely distributed form is represented by two small specimens of equal size (210 millim.). Together with other small material they were preserved in a 5% solution of formol, which has several advantages over spirits. No appreciable shrinkage takes place, and the flesh remains quite firm, while delicate forms such as *Leptocephalus*, and minute membranous structures, as for example the adipose fin of small scopelids, are perfectly preserved. As a colour preservative it is incomparable with spirit, which, as is only too well known, renders nearly all specimens of the same uniform yellowish-brown. The action of formol is beneficial in yet another way. Fishes killed in this fluid die with their members extended, so that the fin formulæ of the smallest forms (*Gobius*, *Salarias*) can be counted with delightful ease and without disturbing a single ray. Lastly, spirit cannot be diluted to more than half its bulk, while formol may be carried at one-twentieth the bulk at which it can be used, a matter of no small consideration to a heavily equipped collector.

CHORINEMUS, *Cuv. & Val.*CHORINEMUS SANCTI-PETRI, *Cuv. & Val.*

Chorinemus sancti-petri, Cuv. & Val., Hist. Nat., viii., p. 379, pl. ccxxxvi.

In Day's "Fishes of India," (p. 230) there is a misprint, by which the second dorsal is made to commence "midway between the snout and the front nostril." In the "Fauna of British India," (p. 174) the passage is simply omitted. It was probably intended to read: "midway between the snout and the front (base) of the caudal."

Another palpable error occurs in the measurement of the pectoral, and as this is copied into the "Fauna," (*loc. cit.*) it may be further mentioned. The length of this fin is stated to be "4½ in the total length." In the Funafuti example (525 millim. to middle caudal rays) it is contained 7·8 times, or 9 times in the extreme length, which was probably the measurement taken by Day.

TRACHYNOTUS, *Cuv. & Val.*

TRACHYNOTUS BAILLONII, *Lacépède.*

Trachynotus baillonii, Lacépède, sp., Poiss., iii., p. 93, pl. iii., fig. 1.

Represented only by a very young example measuring 85 millim. in length.

SCOMBRIDÆ.

ECHENEIS, *Artedi.*

ECHENEIS NAUCRATES, *Linn.*

Echeneis naucrates, Linn., Syst. Nat., i., p. 446; Temm. & Schleg., Fauna Japon. Poiss., p. 270, pl. cxx., fig. 1.

578 millim. is the length of the only "sucker-fish" collected.

GOBITIDÆ.

GABIUS, *Artedi.*

GABIUS BIOCELLATUS, *Cuv. & Val.*

Gobius biocellatus, Cuv. & Val., Hist. Nat., xii., p. 73; Day, Fishes of India, pl. lxiii., fig. 8.

To this species I have doubtfully referred a small specimen of 38 millim., but it is too young for certain determination.

BLENNIIDÆ.

SALARIAS, *Cuv.*

SALARIAS MARMORATUS, *Bennett.*

Salarias marmoratus, Bennett, sp., Zool. Journ., iv., p. 35; Günther, Fische der Südsee, p. 204, pl. cxvi., fig. b.

A nice series of this beautiful species was obtained (largest specimen 72 millim.). Günther's figure gives an excellent representation of the fish; it may be remarked that the markings at the base of the second dorsal are in reality oblique lines directed

backwards and not isolated spots as shown. The white spots on the head-parts, present only in some examples, are raised tubercles. Each supra-orbital tentacle consists of a median tapering stem, whence arises a number of lateral filaments, which are larger and more numerous on the inner side. The nasal tentacles each comprise a short stalk and a palm-like portion terminating in 7-9 digitations. The occipital tentacles are simple. The short streak behind the eye, which Günther remarks is characteristic of the species is, in formol-preserved examples, of a deep blue colour.

SALARIAS QUADRICORNIS, *Cuv. & Val.*

Salarias quadricornis, Cuv. & Val., Hist. Nat., xi., p. 329, pl. cccxxix.; Günther, Fische der Südsee, p. 209, pl. cxvii., fig. b.

The collection contains several examples, all small, however, as the largest one measures only 77 millim. This species was exceedingly common, swarming in every rock pool, as indeed one might imagine by the fact of the natives having designated ("Monaco") a fish not edible nor otherwise useful. When removed from the pools it skipped over the rocks in such a manner as to induce the belief that it was a *Periophthalmus*.

MUGILIDÆ.

MYXUS, *Günther.*

MYXUS LEUCISCUS, *Günther.*

Myxus leuciscus, Günther, Proc. Zool. Soc., 1871, p. 666, pl. lxxv., fig. a; Fische der Südsee, p. 220, pl. cxxi., fig. c.

The only grey mullet collected is assigned to this species. In the "Fische der Südsee" the length of the head is misprinted as $\frac{3}{4}$ of the total length. It should read $\frac{1}{4}$, as in the original description.

The native name is "Foua."

GLYPHIDODONTIDÆ.

TETRADRACHMUM, *Cantor.*

TETRADRACHMUM ARUANUM, *Bloch.*

Tetradrachmum aruanum, Bloch., sp., Fisch., iii., p. 62, pl. cxcviii., fig. 2; Bennett, Fishes of Ceylon, p. 17, pl. xvii.

Represented by one small specimen of only 32 millim. in length. Common throughout the South Seas.

GLYPHIDODON, *Cuvier*.GLYPHIDODON BROWNRIGGII, *Bennett*.

Glyphidodon brownriggii, Bennett, Fishes of Ceylon, p. 8, pl. viii.;
Günther, Fische der Südsee, p. 232, pl. cxxvii. (varieties).

A number of specimens was collected representing five varieties, some of which have been specifically named, they are as follows:—

(1) The original form figured by Bennett. (Fishes of Ceylon, pl. viii.)

(2) Coloration uniform. (*G. modestus*, Bleeker, Atlas Ichth., pl. ccccciii., fig. 9.)

(3) An oblique white band on the body, a dark spot on the spinous dorsal, and a smaller one at the posterior base of the soft dorsal.

(4) Same as No. 3 but without the white body-band.

(5) An oblique white band on the body, a dark one across the base of the caudal. A dark spot on the spinous dorsal, and the whole base of the soft dorsal dark. Anal wholly dark coloured.

GLYPHIDODON SORDIDUS, *Forsk.*

Glyphidodon sordidus, Forsk., Descr. Anim., p. 62; Bleeker, Atlas Ichth., pl. ccccx., fig. 5.

Three very young examples are credited to this species. In addition to the large black spot on the upper surface of the caudal pedicle, there is a small one at the base of the pectoral, and a large black mark on the dorsal extending from the second to the sixth spine; as the transverse bands become fainter, so this mark apparently disappears in adult examples: it is noticeably more pronounced in our smallest specimen (18 millim.), which is little more than a third the length of the largest (48 millim.).

GLYPHIDODON SEPTEM-FASCIATUS, *Cuv. & Val.*

Glyphidodon septem-fasciatus, Cuv. & Val., Hist. Nat., v., p. 463;
Bleeker, Atlas Ichth., pl. ccccx., fig. 5.

One specimen, half-grown. Attaining larger dimensions than some other members of the genus, this species has received a native name, being known to the inhabitants as "Moutou moutou."

LABRIDÆ.

CHILINUS, *Cuvier*.CHILINUS TRILOBATUS, *Lacépède*.

Chilinus trilobatus, Lacépède, Poiss., iii., pp. 529, 537, pl. xxxi.,
fig. 3; Bleeker, Atlas Ichth., p. 66, pl. xxvii., fig. 2.

One example, a widely distributed species in the South Seas, attains a length of two feet.

CHILINUS FASCIATUS, *Bloch.*

Chilinus fasciatus, Bloch., Fisch, v., p. 18, pl. celvii; Günther, Fische der Südsee, p. 246, pl. cxxxiv.

A smaller species, but equally well known. Two specimens were collected under the native name, "Moree."

JULIS, *Cuv. & Val.*JULIS LUNARIS, *Linn.*

Julis lunaris, Linn., Syst. Nat., i., p. 474; Bleeker, Atlas Ichth., p. 90, pl. xxxiii., fig. 5.

One of the commonest fishes of the Indo-Pacific. Name given by the Funafuti islanders, "Lapi."

PSEUDOSCARUS, *Bleeker.*

Four species of *Pseudoscarus* are included in the Collection, and these have been determined as follows:—It is, however, necessary to mention that the identification is by no means satisfactory, as there are such a large number of species (valid or otherwise) named rather than described. "The *Pseudoscarus* are beautifully coloured, but the colours change with age, and vary in an extraordinary degree in the same species. They fade rapidly after death, so that it is almost impossible to recognise in preserved specimens the species described from living individuals."*

Unfortunately none of these fishes were placed in formol, or judging by results obtained in the case of other Labroids caught near Sydney, and so preserved, much of the colour might have been retained.

These individuals, so much alike in our hands, must when alive exhibit great variety of colour and pattern as delineated by Bleeker, for the Funafuti natives recognise and name the several species.

PSEUDOSCARUS PULCHELLUS, *Rüppell.*

Pseudoscarus pulchellus, Rüppell, sp., N.W. Fische, p. 25, pl. viii., fig. 3; Bleeker, Atlas Ichth., pl. x., fig. 3.

Previously recorded from the Red Sea, Mauritius, Java, Celebes, China.?

Funafuti native name, "Oulafi" or "Ourafi."

* Günther—Study of Fishes, p. 532.

PSEUDOSCARUS BATAVIENSIS, *Bleeker*.

Pseudoscarns bataviensis, Bleeker, sp., Java, iv., p. 342 ; Atlas, Ichth., pl. xii., fig. 3.

Previously recorded from Batavia.

Funafuti native name, "Samaria."

PSEUDOSCARUS SINGAPURENSIS, *Bleeker*.

Pseudoscarnus singapurensis, Bleeker, sp., Singapore, p. 69 ; Atlas, Ichth., pl. xiii., fig. 1.

Previously recorded from Singapore and Java.

Funafuti native name, "Ruggea."

PSEUDOSCARUS TROSHELLI, *Bleeker*.

Pseudoscarnus troschelli, Bleeker, sp., Batavia, p. 498 ; Atlas, Ichth., pl. vii., fig. 2.

Previously recorded from Java.

Funafuti native name, "Soumoulaia."

OPHIDIIDÆ.

FIERASFER, *Cuvier*.FIERASFER HOMII, *Richardson*.

Fierasfer homii, Richardson, sp., Voy. Ereb. and Terr. Fishes, p. 74, pl. xxxiv., figs. 7-18.

Mr. Hedley obtained a large Holothurian (*H. argus*, Semper,) two feet in length. After it had been in a bucket for half-an-hour, the *Fierasfer* swam out and was bottled in formol. These parasitic Ophidiidæ, as is well known, inhabit the breathing cavities of various invertebrates ; they are said to be quite harmless, though possibly inconvenient to their host.

The specimen does not differ from that described by Richardson, and measures 104 millim. in length.

SCOMBRESOCIDÆ.

BELONE, *Cuvier*.BELONE PLATURA, *Bennett*.

Belone platura, Bennett, Proc. Zool. Soc., 1830, p. 168 ; Rüppell, N.W. Fische, p. 73, pl. xx., fig. 1.

Although I have named the single *Belone* obtained, as above, I cannot be certain of the determination. Its characters, however, on the whole ally it with this species.

Native name, "Kashufi."

HEMIRHAMPHUS, *Cuvier*.HEMIRHAMPHUS BALINENSIS, *Bleeker*.

Hemirhamphus balinensis, Bleeker, Nat. Tydschr. Ned. Ind., xvii., p. 170.

I was at first inclined to regard this "half-beak" as *H. intermedius*. It agrees more nearly with Bleeker's species, and as Cantor has decided that they are specifically distinct, I have no alternative but to name our single example as above. It is not in good condition, and therefore not suitable for purposes of re-description. In company with Flying Fish, the Hemirhamphi were attracted to the canoes at night by means of flaming palm brands, and were secured in hoop nets within the lagoon.

MURÆNIDÆ.

OPHICHTHYS, *Ahl.*OPHICHTHYS COLUBRINUS, *Boddaert*.

(Pl. viii., fig. 3.)

Ophichthys colubrinus, Boddaert, Neue Nord. Beytr. (Pallas's), ii., 1781, p. 56, pl. ii., fig. 3; Quoy & Gaim., Voy. Uran., I., p. 243, pl. xlv., fig. 2.

The three examples obtained agree in having the transverse bands widely interrupted beneath, so that in reality they are only half-bands adorning the dorsal surface. In some examples the bands are nearly as wide as the interspaces, in ours they are very narrow, being but one-sixth the width of the interspaces. There is no dark spot between the bands as found in some specimens, and figured by Quoy and Gaimard.

Wyatt Gill* describes how eels live in holes in the coral and attain formidable dimensions; he also gives a very recognisable illustration of a typical example of this species.

The native name is "Boureriva."

MURÆNA, *Artedi*.MURÆNA FORMOSA, *Bleeker*.

Muræna formosa, Bleeker, Ned. Tydschr. Dierk., ii., p. 51; Atlas Ichth., p. 94, pl. clxxiv., fig. 1.

In its general form and proportions, the single specimen secured, approaches most nearly to this species, but of its absolute identity I cannot be certain. The colouration and general pattern agree well with Bleeker's figure of the adult, and our example exhibits the black spot at the angle of the mouth, and the dark blotch on

* Gill—Life in the Southern Isles, 1876, p. 279.

the gill-opening, which are stated to be of value in determining the species. Two examples in the British Museum are from Ceram and Amboyna respectively.

At Funafuti this eel is called "Foussi" or "Poussi."

MURÆNA BUROËNSIS, *Bleeker*.

Muræna buroënsis, Bleeker, Nat. Tydschr. Ned. Ind., xiii., p. 79; Atlas Ichth., p. 105, pl. clxxv., fig. 2.

A smaller eel is with some hesitancy assigned to this species; while its general characteristics agree with the description, the colour is slightly different. As, however, the colouration in the Murænidæ varies much according to age or other conditions, it is not of such specific value as has unfortunately been relied upon to determine the many described species. Our example, preserved in spirits, is of a greenish-brown colour, the dorsal surface including the fin and the sides from head to tail closely punctated with black, none of the dots being as large as a pin's head.

The ventral surface especially anteriorly is immaculate, posteriorly the spots descend, and the last inch or so of the tail, including the surrounding fin, is dotted like the upper surface.

It would appear that the Funafuti native name for an eel is "Poussi" ("Foussi"), this species being distinguished as "Poussikenna." Eels were so exceedingly numerous among the reefs round the island, that the native boys used to secure them by beating them with a palm leaf stem as they swam in the water. The three species were obtained in this manner. Eels were also caught in the rock pools by means of hoop nets.

BALISTIDÆ.

BALISTES, *Artedi*.

BALISTES FUSCUS, *Bloch*.

Balistes fuscus, Bloch, Schn., p. 471; Bleeker, Atlas Ichth., p. 111, pl. cexxv., fig. 3.

Two adult examples, wherein the caudal lobes are greatly produced and the anterior portions of the dorsal and anal fins much elevated, even more than in Bleeker's figure. The amount of development, which both these fins and the caudal undergoes as the fish attains maturity, will be well seen by comparing this figure with that of Day's,* which represents a young example of the natural size. Rüppell† has illustrated the species of intermediate age.

Funafuti native name, "Oom."

* Day—Fishes of India, pl. clxxviii., fig. 4.

† Rüppell—Atlas, pl. vii., fig. 2.

BALISTES FLAVOMARGINATUS, Rüpp.

Balistes flavomarginatus, Rüpp., Atlas Fische, p. 33; Bleeker, Atlas Ichth., pl. cexxiv., fig. 3.

One specimen secured. It agrees exactly with the figure cited, both as to size and proportions, but the representation is spoilt by the delineation of the scales on the snout, which as Günther remarks are not correctly drawn.

BALISTES ACULEATUS, Linn.

Balistes aculeatus, Linn., Syst. Nat., i., p. 406; Bleeker, Atlas Ichth., pl. cexvi., fig. 3.

Under the name of "Soumou," one example of this beautiful and very widely distributed species is in the Funafuti Collection, and is apparently as common in the Ellice Group as in other islands of the Pacific.

DIODONTIDÆ.

TETRODON, Linnæus.

TETRODON NIGROPUNCTATUS, Bloch.

Tetrodon nigropunctatus, Bloch, Schn., p. 507; Bleeker, Atlas Ichth., pl. cexvi., fig. 4.

The Collection includes two adult examples, both of which when alive exhibited a beautiful lemon colour on the entire ventral surface, thus approaching the variety *citrinella*. One of the two specimens is very spiny, and the other is in part almost naked. Although it is known that some Diodons are able to erect their spines independently of the inflation of the body, personally I had no idea that Tetrodons could accomplish a similar result to such an extent as is exhibited by our specimens. Examining the two side by side one was seen to be exceedingly spiny, while the other as indicated appeared to be devoid of such armaments; it was not until the last named example was turned over that I realised they were of the same species. The right side of this specimen has the spines fully protruded, while on the left side they are deeply imbedded, but can be readily found and protruded by means of a knife or other instrument. A Tetrodon killed with its spines erected may present a very different appearance to one of the same species killed while the spines were imbedded beneath the skin. As the spiniferous character is used in describing or determining the various species, it has been thought advisable to indicate that it may not be so constant as has been imagined.

I find that Günther has drawn attention to the fact that this species varies in its spiny character, but was apparently unaware

that an individual might exhibit each variation as circumstances altered. He writes as follows* :—

“This species varies in a remarkable manner in the extent of the spines over the body : sometimes they project much out of the skin, and cover nearly the entire body like bristles : sometimes they are much less numerous, and nearly entirely hidden in the skin, the greater part of which appears to be smooth.”

Tetrodon nigropunctatus is included in a division characterised by the presence on each side of the snout of “two solid nasal tentacles without opening.” Of this species I would rather say that there is a single tentacle on each side of the snout, each tentacle consisting of a stalk separated at about half its height into two lobes. On examining these lobes with a lens they were seen to be distinctly porous at the apex, and suspecting the presence of a canal one of the tentacles was removed, when two depressions were observable in the pedicle, each depression corresponding with one of the lobes. On cutting sections, the microscope revealed the presence of two black spots which may have been the pigmental and juxtaposed walls of two canals. The tentacles had however been so shrivelled, that nothing more satisfactory could be made out.

The native name of the species, which is very common around the Atoll, is “Soui.”

TETRODON IMMACULATUS, Bloch.

Tetrodon immaculatus, Bloch., Schn., p. 507 ; Bleeker, Atlas Ichth., p. 75, pl. cxxi., fig. 1.

One half-grown example is included in the Collection. The stomachs of all these Tetrodons were crowded with coral, which grated together when the body was touched. In *T. nigropunctatus* the coral consisted of the finer branchlets of a *Pocillopora*, found growing in the shallower water where the Tetrodons were obtained. Some of the pieces swallowed, measured nearly $\frac{3}{4}$ inch in length, and were much branched.

The food of *T. immaculatus*, as exhibited by our specimen, was composed of pieces of the stock of a coral unbranched, and not exceeding a pea in size. With these were associated some Foraminifera, which my colleague, Mr. Thomas Whitelegge, has identified as *Orbitolites complanata* and *Tinoporos baculatus*.

Darwin has noticed two species of *Scarus* as browsing upon corals.†

* Günther—Cat. of Fishes, viii., p. 293.

† Darwin—Coral Reefs, 1874, p. 19.

The fifty-four species here enumerated are those brought to Sydney, but this number does not exhaust even the common fishes of the Atoll, many different kinds not obtained were observed swimming about the coral growth, or in the deep water beyond. Other species were obtained, but for various reasons were not preserved. We are told (page 65) how a giant ray (probably *Ceratoptera*) was harpooned in shoal water in the Lagoon, and the large fins cut off to make a meal for the families of its captors. It is also mentioned that the "Bonito" (*Thynnus*), is attracted and caught with pearl-shell hooks trailed unbaited over the surface, their gleaming nacre being a sufficient temptation. The Barracouta or Barracuda (*Sphyræna*) is also mentioned, and the flying-fish (*Exocoetus*), attracted in the lagoon by torches, and caught in nets, formed a valuable source of food. A shark was caught and can be readily identified as the "Thresher" (*Alopias vulpes*) from a drawing made by Mr. Hedley. This shark is known as "Mungo" to the natives. There is evidence of another shark, for the swords figured by Edge-Partington,* as possibly from the Ellice Group, are armed with teeth, evidently those of *Galeocerdo rayneri*.

Mr. Hedley described to me a fish which there was small difficulty in recognising, and on showing him illustrations of *Epibulus insidiator*, he at once identified them as portraying the fish he described. A species extremely variable in colour, the example seen was wholly yellow.

A Diodon (or rather portion of the skin) was brought home; it was found on the beach, and as it consists of nothing more than spines held together with skin, the species cannot be determined.

Mr. Hedley brought us some account of a large fish found off the Coral Atolls, known to the natives as "Palu," and to the traders as "Oil fish." It is only caught in the deepest water, and is described as having an immense head, enormous jaws, and large scales. I would hazard the suggestion that it is one of the *Macruridæ*, and as little, if any, information has been published about the "Palu," have pleasure in transcribing the following account, for which we are indebted to Mr. W. S. Crummer, of the Department of Lands, Sydney, who received it from the well known traveller and author, Mr. Louis Becke:—

"This peculiar fish is, as far as I know, only found in the Tokelau (or Union Group), the Ellice Group, the Kingsmill Group, and at the isolated islands of Pukapuka (Danger Island), Suwarrow Island, and Manahiki. I do not know for certain, but have been told by many intelligent natives, that the 'Palu' is never to be found among the high islands, such as the Fijis,

* J. Edge-Partington—Ethnological Album (1), i., pl. xxxvii., figs. 6-11.

Samoa, New Hebrides, etc.; that it affects only the low-lying coral atolls, such as the above-named. With the exception of an old trader named Jack O'Brien, now living in Funafuti, in the Ellice Group, I do not think there is among the white traders of to-day another man besides myself who has caught 'Palu.' In the first place, a man must have much experience of deep-sea fishing; in the next, the native inhabitants would strongly resent a strange white man attempting to catch one, for reasons I will explain hereafter—that is, the people of the Line Islands would so resent it.

"A full-grown 'Palu' would weigh up to 150lbs., and be 6ft. long; it being by no means a thick fish; as far as shape goes it is much like the Australian Jew fish. In place of scales it possesses a tough black skin, thickly covered with bright silvery and small horny excrescences growing in the same manner as the feathers of a French fowl—that is, these scales, or whatever you can call them, curl upwards, and feel loose to the touch. The most peculiar features of the 'Palu' are the enormous eyes; the jaws are toothless; the fins resemble those of a Jew fish. The average size is about 3 or 4ft., and weight 40 to 60lbs.

"The ingeniously constructed wooden 'Palu' hook you are already familiar with, so I need not here say anything about it. The line most in favour for 'Palu' fishing is made from the very best cocoanut fibre, 4 or 6 plait. This is of great strength, and above all very light, for it is not unusual to fish in 150 to 200 fathoms, and at such a depth as that the lines, made from 'fetau' (*Hibiscus*), would be too heavy to pull in. A stone sinker, 3 to 5lbs., is attached to the line.

"A calm smooth night is chosen, and after catching flying fish for 'Palu' bait, the canoes pull out into the open—always on the lee side. It is customary to observe the strictest silence, the natives having many superstitions in regard to 'Palu' catching, which is always conducted in a quiet, noiseless manner, different from 'Bonito' fishing, where everyone yells and howls, and works himself into a frenzy.

"The bite of the 'Palu' is hardly perceptible, but on the Island of Nanomaga, in the Ellice Group, where I was left twelve months, I do not remember an instance where we did not touch bottom at 120 fathoms, and almost immediately pull up with a 'Palu' hooked. The hauling up is done very slowly till the fish is within 30 or 40 fathoms, and then as fast as possible to avoid the big *Tanifa* sharks that would seize the fish. Sometimes in 'Palu' fishing we have hooked immense brown eels which, unless our united strength was put on the line, would tie themselves round the coral and cut the line. In one of these eels we found a 'Palu' weighing 20lbs., just dead, showing that these brutes

prey on the 'Palu.' When each canoe has caught two 'Palu' they paddle ashore.

"The fish are apportioned out to the community with the greatest exactitude—every portion of it is edible; the head, bones, and fins, when cooked, turning into a rich mass of jelly. The flesh of the 'Palu,' if left uncooked, never putrefies; it simply dissolves into a colourless and odourless oil—I believe chemists would like to get hold of 'Palu' oil. When cooked, it is not easy to detect any great difference from the flesh of other fish, except that it looks very rich and is dully transparent. Its almost immediate effect on the bowels I have described to you before.

"It is prized above all other fish in the Line and Ellice Groups. In the Line Islands it is called 'Te icka ne peka'—hardly translatable in polite English; but not to be too coarse we will say it means 'the fish that makes you obey the call of nature in double quick time.'

"When I was living on Savage Island, the people then told me that in the older times 'Palu' were caught there, but of late years very rarely, and that the strong currents racing round the island made them (the natives) afraid to venture out at night; but I surprised them when, with two old warrior fishermen, I caught five 'Palu' in one night, in 80 fathoms only, and with a steel fish-hook. I set the fashion, and the extinct art was revived during my stay there, and I sold any amount of fishing lines and 8-in. hooks, as the Nuie people hate to make anything they can buy or steal."

Three types of Funafuti native instruments, in which portions of fishes have been made use of, have been submitted to me.

One, called a rasp, is simply a dried portion of the tail of *Urogymnus asperrimus*. The skin of this ray, as is well known, is in common use for covering sword and spear handles, etc.

A second, described as a thatching needle, is formed of about nine inches of the beak of a Sword Fish (*Histiophorus*). Another needle used for a similar purpose is the caudal spine of one of the larger Sting Rays (*Trygonidae*), the serrations having been ground down to render the tool sufficiently smooth. The native name of the ray is "Feimanu."

A number of lancets form a third type. They are very neatly made of a piece of stick cleft at the end, into which is lashed a shark's tooth. The teeth are possibly from *Carcharias lamia*; those from the lower jaw would make admirable lancets, but personally I should not care to be operated upon by the serrated teeth of the upper jaw—both types of teeth having been similarly utilised.

EXPLANATION OF PLATE VIII.

Fig. 1. *Mus exulans*, Peale.

- a. Skull in profile; enlarged $1\frac{1}{2}$ diameters.
- b. Ditto, from above; ditto.
- c. Ditto, from below; ditto.
- d. Upper molars; greatly enlarged.
- e. Hind foot; natural size.
- f. Ear; ditto.

Fig 2. *Mulloides samoensis*, Günther.

- a. Scale from anterior portion of lateral line, showing branched tube; enlarged.
- b. Scale from posterior portion of lateral line showing bifurcated tube; enlarged.
- c. Serrature of scale; greatly enlarged.

Fig. 3. *Ophichthys colubrinus*, Boddaert.

Anterior portion of body.

