

ART. XIV.—*On the Presence of another Australian Frog in New Zealand.*

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OUR New Zealand fauna can only boast of one amphibian—namely, the indigenous frog, *Liopelma hochstetteri*—which was rare at the time of its discovery, but now is rarer still, if not almost extinct, only being found occasionally on the Coromandel Peninsula.

‡ About the year 1868 several batches of the common green Australian frog, *Hyla aurea*, were liberated in different parts of New Zealand, as Christchurch, Wellington, &c. : these have increased so much that they are now to be seen in hundreds in many parts of the country.

‡ Since the introduction of *Hyla aurea* there is only one other recorded instance of the introduction of frogs into New Zealand—namely, in 1898, when the Agricultural Department liberated another kind of Australian frog in this country.

Mr. T. W. Kirk, Government Biologist, writing in his report, says, under the heading of "Climbing-frogs," "A consignment of six dozen of these insect-destroyers was also obtained and liberated at suitable spots in the following districts: West Coast (North Island), Wellington Province, Wairarapa, Hawke's Bay, and Auckland. This frog is similar to the ordinary common frog, so common in many parts of New Zealand, except that it has a very considerable advantage over that species in that its toes are provided with suckers, which enables the animal to climb trees and houses in search of insects. In Sydney I have seen these frogs at the top of a wall four stories high." Unfortunately, Mr. Kirk does not mention the name of the frogs, and so far I have been unable to obtain it.

As late as 1904 Captain F. W. Hutton included only *Hyla aurea* in his list of naturalised amphibians, inserted at the end of the "Index Faunæ Novæ-Zelandiæ" (page 348). However, for the last thirty years there has been living and increasing in Westland, especially around Greymouth, another species of Australian frog, which, though well known to the residents, was not thought to be very different from the common green frog of Canterbury. My brother, Mr. F. G. Marriner, was the first person to draw my attention to the presence of this amphibian around Greymouth. He told me that the frogs in the district had a

peculiar whistle, which, when a large number joined in chorus, could be heard for some distance.

This at once aroused my interest, and through the kindness of Mr. H. West, Greymouth, I received five live specimens on the 3rd February, 1906.

On inspection I found that they were small frogs from $1\frac{1}{4}$ in. to $1\frac{1}{2}$ in. in length, and of a brown colour; and in order to get them properly named I forwarded two live ones to Mr. J. J. Fletcher, of Sydney, who has done much work on Australian frogs.

He described it as *Hyla ewingii*, D. and B., var. *calliscelis*, and stated that it was included in the British Museum Catalogue of Batrachia (1882), page 406; he also informed me that it is one of the commonest frogs of eastern Australia and Tasmania.

On the 1st March I received about forty more from Mr. H. West, and so had a good opportunity of noticing any variation that might occur between different individuals. When exposed to light they are of a light-brown or even a very pale brown colour; there is usually a broad dark band running down the middle of the back, with two lighter broad bands on each side. The under-surface is lighter, and on the ventral surface of the thighs there is a yellow streak. When buried in the earth, or not exposed to a bright light, they go to dark reddish-brown colour—almost to a dark chocolate; and if one is buried with only a part of its body exposed to bright light, the buried portion turns a dark reddish-brown colour, and the exposed portion, no matter how small it may be, keeps its very light colour, the line of demarcation being very definite.

In the specimens that I received the male seems to be about $\frac{1}{4}$ in. smaller than the female, but otherwise they seem to be the same externally. The average size of my specimens was about $1\frac{1}{2}$ in., but one specimen was about 2 in. in length. The head is large, eyes prominent, and snout short; hind feet are webbed, but fore feet are not so; all the digits have suckers at their tips.

The frogs in my case seem to be more strictly nocturnal than *Hyla aurea*, for they seldom come out in the daytime, except in wet weather. I kept a large number among some grass in a bell jar for some days; at night-time they could be seen climbing all over the sides of the jar, but in the daytime they were almost all invisible. Since then I have kept them in a glass aquarium, with a dish of water and turf, but I seldom see them out in the daytime. Mr. H. West tells me that they are best caught at dusk or later, when they crawl over the grass, &c., and can be located by their peculiar cry, which somewhat resembles a whistle when compared with the hoarse croak of *Hyla aurea*.

ARBOREAL HABITS.

Hyla ewingii is a true climbing-frog, but according to Mr. J. J. Fletcher it has, at least in Australia, altogether or nearly lost the arboreal habits of a tree-frog. In Westland, however, it still seems to do a fair amount of climbing.

Mr. A. P. Harper, of Greymouth, in a letter to me, gives the following account of their climbing propensities: "I have personally seen these frogs (*Hyla ewingii*) crawling over black-berry bushes at a height of from six to eight feet above the ground, and also in the middle of a patch of berry, five yards by three at least. They even crawl along the thorny stems. I have also seen them on the *macrocarpa* and in the branches of the natural creepers on a dead tree-stem. The highest these frogs climb above the ground is, I should say, about eight feet. On one old tree-stem covered with creepers, ferns, &c. (as one so often sees here) there are nearly always some singing-frogs. It is just above a pool which exists in wet weather only. I rather think they climb when the pools are dry, but I am not sure."

Several that escaped from me on the 9th March I afterwards found clinging to the top of grass-stems about two feet from the ground. Whether the abundance of bush in Westland has stimulated the frog to make use of a power which it has almost lost in Australia is difficult to decide. At any rate, the frog's environment in Westland would certainly be conducive to tree-climbing, and the abundance of undergrowth and creepers would make it very easy work.

BREEDING HABITS.

Hyla ewingii evidently extends its breeding season into the autumn, for on the 1st March two lots of spawn were laid in the aquarium.

On the 11th and 12th most of the eggs hatched out, and the tadpoles, dark-blue in colour, after swimming about for a little time, finally fastened themselves to the water-weeds or to the sides of the aquarium.

After about three weeks of normal development the tadpoles had grown to about 17 mm. in length.

On the 22nd March I put five into an aquarium, which I shall call A; it was out in the open, about 2 ft. by 2 ft. by 1 ft. in size, and held 4 cubic feet of running water. Five others I put into an aquarium (B) situated in a hothouse. The tank was 2 ft. 8 in. by 15 in. by 7½ in., and held about 2½ cubic feet of standing water. During the autumn they were always visible swimming about in the aquarium, but when the cold weather

came they all disappeared. However, in aquarium B, whenever warm weather prevailed a solitary tadpole would appear from time to time, but in the coldest part of the winter no tadpoles were visible. It seems to me that when tadpoles remain as tadpoles all the winter, they must either bury themselves in the mud or else hide away among the water-weeds at the bottom of the aquarium, for I could never see any sign of them during the cold weather.

In the spring two tadpoles appeared in tank B, and only one in tank A, though no doubt several crayfish, which were living in the same aquarium, were partly responsible for the smallness of the number of survivors in the latter. Though the aquariums had plenty of water-weeds and submerged rocks, there was no place where the tadpoles could find a shallow landing-place where they would need their limbs for crawling, and the result has been that neither the lungs nor the limbs have been developed.

In autumn they would often come to the surface and take in large mouthfuls of air, as most tadpoles do, but since the winter they seem to have no inclination to come to the surface, but act to all intents and purposes similar to fish.

It has been stated that not only will tadpoles keep as tadpoles when reared under such conditions, but that they will increase in size in proportion to the size of the tank in which they are kept. Though three specimens are not sufficient to prove anything, yet the tadpoles in my aquariums do seem to uphold this fact. All of them were about 17 mm. in length when put into the tanks, and now the two in the tank holding 2½ cubic feet of water are only 25 mm. and 30 mm. respectively, while the one in the tank holding 4 cubic feet of water is now 45 mm. in length.

DISTRIBUTION.

It seems almost certain that these frogs first made their appearance at Greymouth, whence they have extended inland and south.

From Greymouth they have spread either naturally or artificially up the Grey River for at least twenty-four miles to Ahaura, and very likely further, but so far all the places where I have found them to be present are on the south bank of the river, and none on the north, though it is not at all unlikely that they are on the opposite bank also.

At Brunnerton, eight miles from Greymouth along the river, they are plentiful, and seem to be increasing. No other kinds of frogs are said to be found there.

At Stillwater, nine miles from Greymouth and a mile past

Brunnerton, according to Mr. Mallock there are both the green and brown kinds present, though the latter are more numerous and are increasing.

At Ahaura, twenty-four miles up the river, only the brown frogs are present, and these appear to be increasing.

At the centre of their dispersion, Greymouth, they are said to exist in very large numbers, and seem to be increasing.

The only other place where I have them recorded is Hokitika, twenty-two miles south of Greymouth, and there is no reference to them being found in between these towns, so that it is very unlikely that they travelled overland—indeed, rumour says that they were brought by an unknown person from Greymouth.

At Hokitika *Hyla ewingii* is now very scarce, if not quite extinct. Mr. James King, of Hokitika, says that ten years ago the big green frog (I suppose *Hyla aurea*) was introduced, and perhaps this has something to do with the decrease of the brown ones. From what I have seen of the *Hyla aurea* it would find the small brown frog very eatable, and if it does not stop at eating its own kind there is very little chance of it sparing the small strangers. It is evident that they have not extended in any direction from Hokitika, for I have no place outside of that town where they are known to be present.

ITS INTRODUCTION.

The next question is to find out how this frog came to New Zealand.

I thought that at first it might be an indigenous frog, but there seems to be no evidence whatever to support this theory. There is no record of it in the early days of settlement, and at all the places where it has been found its origin can be traced directly or indirectly to Greymouth.

As the frog was so common on the east coast of Australia I thought that probably it came over among the ballast of some ship trading between that continent and Greymouth, but this theory was upset on making further inquiries in Westland.

Several of my correspondents say that these brown frogs, *Hyla ewingii*, were brought from Tasmania by a Mr. W. Perkins in 1875, and through the kindness of Mr. T. Eldon Coates, of Greymouth, I received the report which is generally accepted in that town. He states that a Mr. W. Perkins, who was a barrister in Greymouth for some time, brought some of these frogs from Tasmania in a glass bottle in 1875. They were liberated in a drain in Alexandra Street, Greymouth, whence they have spread to the surrounding country. They have remained in

great numbers in and about the spot where they were originally liberated. The main facts of this account I have also received from several other Greymouth correspondents.

These frogs cannot, as some have thought, be the ones liberated by the Agricultural Department in 1898, because they were never liberated on the west coast of the South Island at all; besides, the two could never have been confused, owing to the difference in size, colour, and general appearance.

Several of my correspondents have known *Hyla ewingii* around Greymouth for twenty or even thirty years. Mr. H. West has written to say that he remembers them twenty years, and Mr. West, sen., for about thirty years.

The presence of this frog in Westland in 1875 may somewhat explain a mystery which has never been cleared up: In 1875, before the Westland Institute, Mr. F. E. Clarke read a paper on "Notice of a Tadpole found in a Drain at Hokitika." He explained that he had found one in a drain which was being cleaned out by some labourers. After discussing the amphibian he writes, "No frogs or frogs' spawn having been introduced nearer to the west coast of New Zealand than Nelson and Christchurch, it is puzzling to conjecture in what manner the little stranger arrived in a territory having a climate so thoroughly congenial to its kith and kin."

Mr. Clarke was evidently unaware that about three years before he wrote his paper *Hyla ewingii* had been introduced into Greymouth, and they could easily have been brought from Greymouth as adults by some unknown person, or else perhaps the spawn was carried across the intervening twenty-four miles by some water-fowl. At any rate, there is not so much of a mystery about the occurrence, when frogs were not more than twenty-four miles away, as it would have been when they were no nearer than Nelson, about a hundred and fifty miles as a crow flies.

As this frog can climb well, I think it would be worth while introducing it into Canterbury and other parts of New Zealand in order to deal more effectively with the insect pests, as the common green frog is unable to reach insects that do not come near the ground. Already several of my specimens of *Hyla ewingii* have liberated themselves, and if not destroyed by birds might establish themselves around Christchurch.

In closing I should like to express my thanks to all those who have supplied me with information, and especially to Mr. H. West for the trouble he has taken in procuring live specimens for me.