ART. XXII.—*On the Fresh-water Shells of Rissington, Hawke's Bay.*

By F. HUTCHINSON, Jun.

[*Read before the Hawke's Bay Philosophical Institute, 26th October, 1900.*]

RISSINGTON is a small sheep-run situated about seventeen miles north-west of Napier. It stands, as one might say, on the border between the rich monotonous hills and plains of the seaboard and the wilder gorge-rent uplands that lift wave upon wave inland to rest at last on the stony flanks of the great Kaweka Range.

The surface-features of its 4,000 acres consist of a bold limestone-crowned hill standing out from a base of the hummocky rolling country—such a feature of the papa country of this north-east portion of Hawke's Bay; sweep upon sweep of low rounded hills, drained by a network of tiny gullies feeding the four main streams that with the wear-and-tear of ages have cut great clefts lengthwise down the place—clefts wide and tame in their lower courses, where they join the Mangaone, a tributary of the Tutaekuri, but deepening inland into the wildest of gorges, walled with great cliffs of blue marl and brown conglomerate.

The gullies of the uplands for the most part are poor in springs, furnishing each its tiny creek of surface-water during the winter rains, but grass-bottomed and dry in the summer months. Here and there, however, a spring supplies a quiet earth-bottomed stream, swampy, with still, deep pools—pools loved by the poor hunted ducks when persecuted from their feeding-grounds in the wide lakes and swamps of the lowlands—pools that in two cases broaden out into the dignity of small lakes. The main creeks of the gorges are of a totally different character — wearing, tearing, turbulent shingle-carriers, hurrying down over wastes of rounded pebbles that ever shift and grind and pummel each other on their way to feed the great shingle-spits of the coast. But one and all—lakes, pools, and brawling torrents—have their quaint little shelled inhabitants, from the smallest yard-wide pool of permanent water, with its score or so of univalves and bivalves, to the countless hosts crawling over the mud of the lake-bottoms or clinging to the water-worn boulders of the creeks.

Now, we have in New Zealand some twenty-three species of fresh-water shells, eighteen of which are univalves or spirals, and five are bivalves. Of these we have on Rissington eight

species, of which six are univalves and two are bivalves. We have thus, roughly speaking, a third of the number of fresh-water shells ranging through our Islands. Dividing the univalves again, we have two of the river-snails, or *Hydrobiidæ*, and four of the pond-snails, or *Limnæidæ*.

To understand the distinction between these river-snails and pond-snails, let me take you down to the mouth of Sturm's Gully for a few minutes. You will find the rocks of the beach there studded with the shells of two relatives of the English periwinkle—one, *Littorina cincta*, a small edition in shape and colouring of the English shell; the other, *Littorina cœrulescens*, a dirty-white shell with a broad band of slate-blue running round its turns or whorls. Pick one off the rock, and you will find it quickly shuts up the entrance of its shell with a neatly fitting horny cap or lid, the operculum. If you look about in the fennel-jungles of the cliff-bottom you will find plenty of that handsome familiar garden-pest, the common snail. Notice that as he drags himself, bubbling, into the recesses of his shell he has no operculum. The periwinkles have gills, breathing water; the snails have lungs, breathing air. Now, the river-snail is, broadly speaking, a periwinkle that in the course of ages has taken to the fresh water instead of the salt—in fact, "river-periwinkle" would be a much more appropriate name for it; the pond-snail is a relative of the snail that has taken to fresh water in preference to a land-existence, still retaining, however, its lungs.

River-snails (Hydrobiidæ).

Our two species of river-snails are *Potamopyrgus antipodarum* and *Potamopyrgus corolla*. They are both very common in all our creeks, lakes, and pools—in fact, in any of our permanent water. Drag out a bundle of duckweed, water-cress, or any floating herbage or timber, and you will be sure to find it studded with tiny black-brown spirals, varying in size from young shells the size of a pin's head to adults up to ¼ in. in length. As a rule, in the more rapid creeks they are under this size, but in the still mud-bottomed pools of our narrow flats they come well up to this measurement.

Potamopyrgus antipodarum is by far the commonest. You will see it is not unlike its sea-going relative, the brown periwinkle—the same rounded whorls, with the mouth of the shell closed by an operculum.

Potamopyrgus corolla is a more striking shell than the preceding species, the whorls being angled or turreted, and along the angle of the last three whorls is a row of spines. These spines are well developed in the shells from still water, but in our rapid creeks they are worn down to short stumps or absent

altogether, only the angle remaining to distinguish it from *P. antipodarum.*

POND-SNAILS (LIMNÆIDÆ).

Of these our four species are *Amphipeplea ampulla, Bulimus antipodeus, Bulimus variabilis,* and *Planorbis corinna.*

Amphipeplea ampulla is common in all our lakes and pools, and occasionally in the still back-waters of our larger creeks and rivers. As its specific name "*ampulla*" denotes, it is not unlike a flask, the first three whorls being perched in a small spire on the greatly enlarged body-whorl. It is a fragile, translucent, horn-coloured shell, from ¼ in. to ⅜ in. in length. Its fragility probably accounts for its absence from the more rapid reaches of our streams. On the shallow, turbulent shingle bottoms its place is taken by the more solid river-snails. Compared with the river-snails, notice the larger, fleshier body, and the absence of the operculum.

Bulimus antipodeus, the largest of our fresh-water spirals, is a stronger, more opaque shell than the "flask snail," and has in the adult a longer, narrower spire. The turns or whorls of the shell run in the opposite direction to those of the "flask snail," going from left to right, and so termed a left-handed or sinistral spiral. The "flask snail," as also the great majority of shells, are right-handed or dextral spirals. Note that the whorls are not keeled or angled, a distinction separating it from the next species, *B. variabilis,* which always has the body-whorl more or less angled. It seems to me that *B. antipodeus* merges by transition forms into *B. variabilis,* but as it is placed as a distinct species I give it as such.

Bulimus variabilis, as its name denotes, is an extremely variable shell—so much so that some authorities rank its varieties, *B. mœsta* and *tabulata,* as distinct species. It is distinguished from *B. antipodeus* by the body-whorl being more or less angled or keeled. *Bulimus* and *Amphipeplea* resemble each other rather closely in the young state, the body-whorl of the former being larger and of the latter smaller in proportion than in the adult shells; but an unfailing distinction is that, whereas the whorls of *Amphipeplea* run from right to left, a right-handed or dextral spiral, those of *Bulimus* run from left to right, a left-hand or sinistral shell.

Planorbis corinna, our last fresh-water spiral, is the solitary member of its genus in New Zealand—and a very small and inconspicuous member too. Of a very different form from the preceding shells, its whorls, instead of being elevated more or less into a spire, all lie on the level, in the same plane—that is, the whorls increasing gradually in size, so that the last or body-whorl is not so large in comparison with the other whorls as in *Amphipeplea* and *Bulimus.* In size it ranges here from

⅛ in. downwards. In some parts of New Zealand it is decidedly larger. The little brown discs are easily overlooked, as they haunt the neutral-tinted reeds and raupo-stems and other floating *débris* of our lakes, particularly as, in common with nearly all fresh-water shells, they are often coated with an earthy deposit—so thickly at times as to blind the inner whorls completely.

Of the common river-mussel I need say but little. We can only just claim it as an occupant of Rissington: in fact, I doubt if we have any living within the boundary, all I have found being dead shells on the banks of the Waihau Creek. A small feeder (dry in hot summers) comes into this creek from one of the Ardlarsa Lakes, in which mussels are plentiful. Heavy floods, raising this lake, will send a few mussels occasionally down the feeder—dead shells, as I have said, careful search having failed to reveal any living bivalves in the Waihau.

Its small ally, *Pisidium novæ-zelandiæ*, our so-called fresh-water cockle, will often escape the ordinary observer from its small size and retiring habits. A translucent shell, varying in colour from pale-horn to nearly white, it is to be found in great numbers sunk in the black ooze or gliding over the sandy mud in all our still, permanent water, in company with the pond-snails, though, like them, absent from the rapid shingle-bottomed streams. Our largest specimens are ⅛ in. in length.

Distribution.

Just a few words as to the distribution of these fresh-water shells in Hawke's Bay.

Taking first the river-snails, you will find them almost omnipresent in all permanent water, whether rapid or sluggish. Far up in the rugged subalpine gorges of the Kaweka, amongst the beginnings of our rivers, I have found the tiny black spirals abundant; following down these streams, in the turbulent cataracts of the middle reaches, they cling in colonies round the boulders, and crawl in thousands over the mud of the back-waters; down through the long shallow shingle-stretches as they widen out between the ever-lowering hills, to shrink again to the deeper sluggish channels of the plains, right down to the salt swamps of our river-mouths, these shells swarm. Yes, in teeming millions they fringe the quiet, reedy, bird-haunted creeks that—draining our Napier Swamp and the rounded sun-baked hills of the seaboard—feed and fill the ever-shallowing Inner Harbour. Right down all these into water with a good strong tang of the salt in it, only ceasing, in fact, as the channels burgeon out into the wide mud-flats of the harbour. They get at

times, in this way, into very mixed company, lying huddled under the tide-touched salt weed, fringing the countless crab-holes, holding common ground with the coast-loving sea-folk, grey whelks, black auger-shells, and all the fascinating denizens of a swampy littoral. In fact, a mild admixture of salt seems to suit them better than quite fresh water. I have got my largest and most perfect specimens round these sea-creeks; and, as a rule, the farther up country one goes, and the more rapid the stream, the smaller will the river-snails be. Does not the fact of their flourishing so well in these brackish swamps give a clue to their originally salt-water origin? Curious connecting-links between land- and sea-shells are furnished by two species of the same genus that are common about the Inner Harbour of Napier—*Potamopyrgus cumingiani* and *pupoides*. Both plentiful in the lower courses of the Napier Swamp creeks, they shun alike the pure fresh water above tidal influence and the stronger salt of the broads of the Inner Harbour.

Let me quote a short passage from that delightful book, "The Dispersal of Shells," by H. W. Kew: "Fresh-water forms are said to have been originally derived from the sea; and, even now, marine animals in all probability are gradually adapting themselves to fresh water." May we not class these shells as being of those that "are gradually adapting themselves to a fresh-water existence"?

The pond-snails are more fastidious in their choice of a home than the river-snails. They frequent, as I have said before, our lakes and stiller weed-choked streams and pools. The "flask snail" I have occasionally found in the back-waters of rapid streams, also *Planorbis;* but *Bulimus* seems altogether confined, in our district at least, to lakes and the still pools of the mud-bottomed creeks of the uplands. Unlike the river-snails, our pond-snails give the salt water a wide berth, pausing inland along our river-banks long before the river-snails have attained the limit of their seaward march amongst the purple wastes of crab-haunted salt weed.

I have said that our fresh-water mussel is common in many of our lakes. It is, however, rather local in my own district—that is, the country lying between Napier and the Kaweka Range. Extremely abundant in the small lakes on the Petane side of the Flagstaff Range, it is absent from many of the lakes farther inland. I find it only in the upper reaches of the before-mentioned Waihau Creek and the Mangaone River. In this it is very unlike its small relative the fresh-water cockle, which is with us almost universally distributed, spreading also with great rapidity. A small pool formed in one of our home paddocks some two years ago by the building of a road-embankment, and isolated from the surrounding

well-stocked creeks and drains, has now numbers of the *Pisidium* in it.

Now, the question arises, How did these slow-moving, water-loving shells manage to so thoroughly populate these isolated outlying lakes and pools? One can understand their presence up all the streams: they are free-swimming for a time after leaving the egg, thus enabling them to disperse rapidly over the stiller waters, though this would act rather as a disadvantage than otherwise in our rapid streams—the feeble, tiny folk must be swept out to sea in millions during floods; more is due to the slow crawling of the adult shells, working through the ages up stream.

But, though both pond- and river-snails will pass up or down the tiniest of runlets, or even over moist ground for short distances, the tracts of dry land between many of our pools and the nearest running water are far too wide for their crossing unaided. As for the river mussel and cockle, their powers of locomotion are even more limited.

It was not without purpose that I mentioned our waters as the refuge for hunted water-fowl. Let me quote a celebrated experiment of Mr. Darwin's: "I suspended the feet of a duck in an aquarium where many ova of fresh-water shells were hatching, and I found that numbers of the extremely minute and just-hatched shells crawled on the feet, and clung to them so firmly that, when taken out, they could not be jarred off, though at a somewhat more advanced age they would drop off. These just-hatched molluscs, though aquatic in their nature, survived on the duck's feet in damp air from twelve to twenty hours; and in this length of time a duck or heron might fly at least six or seven hundred miles, and, if blown across the sea to an oceanic island, or to any other distant point, would be sure to alight in a pond or rivulet." Now, just watch a wild duck as, with startled resonant "quack," he rises from the water or oozy shore of his feeding-grounds, how neatly the folded web-feet are tucked under his tail as he hurries off inland for, perhaps, a thirty-mile flight before resting the sole of his foot on ground again. Look round any of our lake-edges and still streams, and note what hosts of tiny shells there are in the ooze of the margin; then imagine the broad, lined surface of the duck's foot, strewn with these shells, as, with restful, satisfied splash, he alights in some quiet upland pool, to tenant it unwittingly with tiny shells.

On a visit to the Flagstaff waterholes—small lakes that, as I have said before, swarm with mussels—searching in the mud of the margin, I found young river snails and cockles very abundant, pond-snails decidedly scarce, and of mussel-fry none at all, only securing specimens of the last with the

aid of a hand-net in from 2 ft. to 4 ft. of water. These young mussels were about the size of a pea; the other shells ranged down to the size of a small pin's-head.

If this rule in any way holds good for other lakes, one can easily see that, apart from their larger size, the chance of the mussels being carried away by duck, or even the long-legged wading pukekos, would be infinitesimally small compared to that of the other shells. Certain it is that newly formed pools are soon stocked, in some way or other. The pool referred to as having been formed only some two years ago has now some four species of shells inhabiting it. I watched with great interest the development of its fauna and flora. At first a raw stretch of yellow water, ebbing round drowned docks and grasses; its earliest tenants, and that in a very few weeks' time, were the larval forms of gnats and dragon-flies. In about a year's time young shells of *Amphipeplea ampulla* appeared; then, later, *Potamopyrgus antipodum;* then the white shells of *Pisidium;* and, lastly, the flattened brown form of *Planorbis corinna.* Hosts of *Cypris,* a minute bivalve Crustacean, appeared after the first year. Besides these, the pool, now brown and clear, supports a mixed assemblage of lowly organized plants: the wool-like green algæ soon appeared; brown blobs of the same family roll about the bottom, with shapeless masses of clear jelly, and delicate network sacs, evidently low forms of animal life. And all these were carried in, I imagine, on the feet of wandering cattle, or by the pukekos as they stalked to and from the adjacent well-stocked creek and drain.

These fresh-water shells are one of our few native families that benefit by the introduction of an alien. Since the rapid spread of that rampant cross-bearer, the water-cress, pools and drains once dry during summer now lie shrouded in protecting green, affording pleasant moist shelter, and probably food also, to these and a host of water-loving insects.

ART. XXIII.—*Scinde Island, from a Naturalist's Point of View.*

By F. HUTCHINSON, Jun.

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THIS is most emphatically not a deep paper from a scientific point of view, being just a rough sketch of a few of the most interesting features of the natural history of this most in-