

the forest and open country. Can the small *Mus maorium* also be an emigrant at this date, or would the more powerful and savage *Mus decumanus* destroy them on the voyage?

Particulars of a rat's nest in a *C. macrocarpa* tree, which is mentioned in the *Hawke's Bay Herald*, where two black rats were killed by the employés of Mr. Goddard, of Havelock North, have not yet come to hand.

ART. XXXIII.—Notes on Patellidæ, with reference to Species found on the Rocks at Island and Lyall's Bays.

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I HAVE placed upon the table this evening some specimens of the *Patellidæ* obtained from the rocks and pools of Island and Lyall's Bays, several of which, as you will see, are of great beauty; and I also exhibit a couple of specimens of a species found at the Kermadecs, as an example of the remarkable increase in size which animals of this genus attain in warmer seas. It is at once apparent to observers that the shells of all the animals belonging to this family differ materially from those of any other of the shelled Mollusca, inasmuch as they are destitute of any special aperture, and show no trace of a spire. Each consists of one piece only, the ordinary form being that of a widened cone, varying in height in the several species, and having the apex more or less distant from the true centre. The animal which occupies each of these shells is large in proportion to the dimensions of its shell,—is furnished with a fleshy mantle, under the projecting edges of which the respiratory organs are placed,—and possesses tentacles carrying eyes on the undersides of their bases.

But its most remarkable organ is the tongue, which, in the great majority of the species, consists of a flattish and extremely narrow ribbon-like body varying from 3 in. to even 10 in. in length, soft and vascular and somewhat dilated at the tip, the whole length, except the tip, being armed with three practically parallel rows of spinous teeth, pointing backwards. Each of the teeth of the middle row is cut into four points, and those of the outer rows,—which are not absolutely opposite to those of the middle row,—into two points only; the width of the surface on which the three rows are placed does not exceed $\frac{1}{2}$ in. These teeth are used for rasping down during their passage into the gullet the minute seaweeds on which the

animal feeds. Mr. Patterson, who first observed the tongue of the limpet, mistook it for some strange species of worm, but on examining several animals the supposed worm was found in all, and great was his astonishment when he discovered that what he saw was in reality the tongue of the animal, and not a mere intruder into the privacy of its conical abode. So long as the animal is not feeding the tongue is rolled into a spiral like a spring, but when used for feeding it is thrust out from side to side until it has become charged with food, and is then withdrawn into the stomach, unloaded, and again put forth. This class of tongue, however, except as regards its remarkable length, is common to all the phytophagous gasteropods, and is thus alluded to by Johnson in his "Introduction to Conchology": "When a phytophagous gasteropod is about to eat it thrusts forward a spinous tongue, protruding at the same time the lip on each side, by which the tip of the tongue is compressed and forced into the form of the bowl of a spoon. The food is then taken hold of by the lips, and, being pressed by the tongue against the upper horny jaw, a portion is bitten off, and this is passed along the tongue by a peristaltic motion of that organ, and by the retropulsive action of the adjacent muscles, until, torn and rasped by the sharp teeth, it is made to enter the gullet. At the entrance of this canal there is a uvular caruncle, which is supposed to be the seat of the animal's taste, and on its side a pair of lobulated salivary glands, or sometimes two pairs, which convey a secretion into its upper part to lubricate and soften the mass. The gullet is a muscular canal, lined interiorly with a mucous coat, presenting the same structure as the whole alimentary canal and is generally plaited in a longitudinal direction." I do not know that any of the New Zealand species have been dissected, or that any detailed observations of their habits of feeding have been made, and as I have not had time myself to make any such observations I must leave it to others to determine to what extent the foregoing general remarks apply to our indigenous species.

The family *Patellidæ* consists of three sub-families, the species of which are very numerous and widely distributed, though I believe none exist in the Arctic seas, and we may therefore assume that none will be found in the Antarctic zone. As already mentioned, the largest species are usually found in the warmer seas, the example which I show from the Kermadecs illustrating this rule. Each of the sub-families is specially liable to variation in the form, colour, and surface of the shell, and these characters therefore must not be implicitly relied upon in the determination of species. Several of these animals possess the means of wearing the surface of the rocks to which they adhere into pits coincident in form

with the edges of their shells, each of these pits constituting the permanent abode of one individual, to which it regularly returns after its excursions in search of food; but I suspect that in the case of those which possess this habit it is only acted upon when the animal has attained its full growth. The pits referred to are said by Mr. Gosse to be excavated by means of sharp crystals of silica embedded in the substance of the under-surface of the animal's foot. I am informed by my son that the Kermadec limpet usually occupies slight elevations, the surrounding rocks being worn away by the action of the waves.

In the case of the large species which I now exhibit this habit certainly cannot prevail, for, contrary to the usual rule as regards the *Patellidæ*, its shell is insufficient in size to hold the entire animal, the mantle at all times protruding beyond its edge, and remaining fully exposed, whilst it also possesses in only a feeble degree the power of adhering to the rock. It is evidently a rare species too, for I have only found four specimens during the last year and a half.

The common limpet of the English coast affords a special example of the habit of using a fixed abode, the full-grown animal at all events invariably occupying an oval pit corresponding exactly in shape and dimensions with its shell. This habit was first noticed by Mr. Jukis, a native of Guernsey, who tested it by marking individuals to avoid mistake, and then noticing their roaming from and regular return to their places of rest, where the shell in each case was found exactly to correspond with the surface of the rock to which it was attached. "There," he says, "it will rest or sleep, and only relax its strong adhesion when the muscular fibre becomes exhausted by long contraction, in which state a sudden blow given horizontally will easily displace it."

Collectors well know the force with which the limpet adheres to the rock, especially when it becomes aware of an attack, and has had time to put forth its muscular strength. Réaumur found that a weight of from 28 lb. to 30 lb. was required to overcome the force with which this adhesion took place in some cases, which he attributed wholly to the exercise of muscular energy; but Dr. Johnson, in dealing with this point in his "Introduction to Conchology," mentions that if the finger be applied to the foot of a detached animal, or to the spot on which it rested, it will be held there by a very sensible resistance although no adhesive matter is perceptible, but that if the spot be moistened with water no further adhesion will occur on the application of the finger,—the adhesive matter having as he supposed been removed, the sea-water being apparently the solvent by which the animal's connection with the rock is loosened at its own will."

Careful observations on these points in regard to our own species will be of special interest, and would not be difficult if conducted by means of a well-established aquarium, the materials for which are obtainable from the localities referred to.

In this other species which I now exhibit you will see a remarkable instance of another habit of these animals—namely, that of adapting the rim of its shell to the shape and irregularities of the substance to which it adheres. Looking at the bizarre shapes of the shells before you it is difficult to suppose that the animals had the ordinary regular form possessed by such as inhabit strictly symmetrical shells; but as a fact the inhabitant of each of those now shown was quite as regular in form as those which occupied the perfect ovals of the other specimens, as you will see on looking at the dried specimens now shown. I am inclined to doubt whether this particular species ever leaves its special site, and to think either that it depends for its food on the numerous minute vegetable organisms which are brought within its reach by the tidal water, or that it finds sufficient pasture at all times within reach of its tongue. I have found that nearly all the species I exhibit form, as it were, separate colonies, and are not generally intermixed on any particular rock; but, even if this observation should be corroborated, I am not prepared to suggest any particular reason to account for the fact.

In Europe the common limpet constitutes an article of food, especially amongst the lower classes who live in the neighbourhood of the sea-coast, many tons of them being so used daily in some localities; and, although the edible portion is coarse, hard, and unsavoury, its use has often been the means of escape from the horrors of famine.* It is largely employed as bait for sea-fishing, but is inferior even for this purpose to many other species of the Mollusca.

To the student of natural history the varied forms of this family will be found to be full of interest, and will afford abundant scope for the exercise of intelligent observation; and I venture to express a hope that some of our young naturalists will endeavour to settle many points which are still moot in regard to their life-history and habits. They will find ample means for doing this in the localities from which I made my own collections.

* It is interesting to note that the animal of the limpet was used for food by primitive man, for the shells occur in large quantities in their ancient cooking-places; whilst necklaces formed from the shells are also found in the most ancient cromlechs or subterranean burying-places.