A PRELIMINARY NOTE ON THE MANNER IN WHICH THE OYSTERCATCHER (*HÆMATOPUS OSTRALEGUS*) ATTACKS THE PURPLE-SHELL (*PURPURA LAPILLUS*).

By J. M. Dewar.

The Oystercatcher feeds upon the contents of the Purple-Shell to a limited extent it is true, yet sufficiently to justify its inclusion among the forces which control the numbers of this predatory mollusc. The opened shells which I have collected vary from three-quarters of an inch to one inch in extreme length from apex to base. The shells are detached from the rock with apparent ease. The Oystercatcher passes or forces its bill well under the shell, and by a quick lateral movement of the head tips the shell over so that the aperture looks upwards. In this position it is seized crosswise within the tips of the mandibles, and carried to a suitable place; it may be a little crack in which the shell is laid lengthwise, or a slight hollow in the rock, or very often a patch of firm sand. These advantages are optional, and room to work in seems to be the main object. Having set down the shell the Oystercatcher pushes its bill over the outer lip in a downward direction, introducing into the aperture the upper mandible alone. Through the point of the latter it administers a number of hammer-like blows, or, resting the point on the interior, a series of powerful thrusts, or pressing firmly and continuously it moves its head slowly from side to side, as if imparting a rolling motion to the shell in the direction of its long axis. If the bird is successful, a fragment is displaced from the under side of the shell. It is disc-shaped, and about a quarter of an inch in diameter. The edge may be straight, more usually it is bevelled inwards. The circular opening to which the disc corresponds is divided into two parts by the margin of the operculum, thus proving that the point of the upper mandible is pushed into the angular recess between the operculum and the inner wall. This marks the end of the first stage, and frequently it is never reached, many of the shells being strong enough to resist the efforts of the Oystercatcher.

The rolling motion to which allusion has been made can be demonstrated experimentally when the bill or other instrument is introduced into the aperture as near the apex of the shell as possible. The terminal portion rests in a vertical furrow, and when the upper end is oscillated in the direction of the long axis of the shell the latter rocks to and fro; as it rises on the apex the part directly under the bill, being unsupported, is driven out with moderate force in the typical form of a disc.

At the second stage the shell is turned over so that the normal aperture looks downwards or to one side. The Oystercatcher picks up and drops the shell to make it roll until it rests in the desired position. Usually one rolling is sufficient, but it may have to be repeated once or twice. From its form the shell can come to rest in one or other of two approximate positions—with the abnormal opening looking upwards, or with the aperture uppermost when the abnormal opening looks to one particular side. It cannot face the other side, because the shell will at once roll into its original position. When the abnormal opening looks upwards—perhaps the more common result—the Oystercatcher pushes its bill into the body whorl towards the ground and the apex of the shell, and then lowers its head in one swift, powerful movement. The outer lip appears to form the fulcrum of the lever. By its inclination away from the axis of the shell and by its sharp edge it resists the tendency of the shell to revolve. This resistance, however, must be increased by the line of leverage being as much as possible in the long axis of the shell. The methods applicable at the first stage may be used instead of that just described. When the abnormal opening looks to one side the Oystercatcher may employ that method, but a considerable part of the leverage will be wasted before the sharp edge of the outer lip bites the ground, and generally the methods of the first stage are adopted, the upper mandible alone passing through the abnormal opening, and travelling as much as possible towards the ground and the apex of the shell. Probably there is here an inclination towards the continuous pressure and rocking manœuvre. The result is strikingly uniform. A second piece of shell is driven out on the side of the first abnormal opening nearer the apex and further from the aperture. Nearly twice the diameter of the first disc,

it is a semilune, the circumference of the circle of which it forms part intersecting that of the first opening. The edge is either straight or bevelled inwards. This second and larger portion is found rarely in one piece. The greater part of the contents is now accessible. The mollusc is removed piecemeal, each part being seized and shaken from the shell in three or four mouthfuls. Just as the Oystercatcher may fail at the first stage, so it may be unequal to the second. In this event it removes through the first opening as much of the soft parts as are within reach.

On sand the shell sinks under the force applied to it with an inclination towards that side on which the force is greater, and one can learn indirectly by which method the force was applied. During the second stage a column of sand rises through the aperture to the first opening, and, adhering to the flesh, obscures much of it, or renders it distasteful. On the other hand, one may suppose that the yielding sand diminishes the shock which the bill has to sustain.

So far I have sketched what appears to be the general mode of attack, and what is certainly its common result when the attack is successful. The ideal result seems to be the extrusion of a piece of shell, equal in area to that of the two discs, at the first stage, so that the Oystercatcher can clear out the contents of the shell with the minimum of trouble. The extruded portion may be in one piece, or broken up into two or more fragments. The gap formed in the shell is irregularly pear-shaped or elliptical in outline, and does not show the symmetrical dentation characteristic of the type. Sometimes the Oystercatcher, falling short of its ideal as it were, is content to make the first small opening, and, without reversing the position of the shell, to remove a portion of the soft parts by poking its bill in from below.

As to the frequency with which the Oystercatcher attacks the Purple-Shell, my own experience indicates that the act occurs locally and very irregularly. Days pass, and no opened shell is seen on the feeding-grounds; on single days I have gathered eight or nine. A habit may be developed on parts of the extended coast-line of this and other countries, but there are reasons why it should not be. I happened to witness an Oystercatcher attack seven shells in succession. It failed to gain

access to four of them. One, after being submitted to a second bout of hammering, was picked up, shaken violently, even passionately, and then thrown away. To have four failures out of seven attempts is bad, and, though it is not truly representative, yet the average must be high, much higher than with Mussels, Limpets, &c. With these, if one may put it so, the Oystercatcher has a reasonable prospect of success, provided that it attends to what are presumably the conditions of success, and it can satisfy its wants with great rapidity. On the other hand, the Oystercatcher has no security whatever that it can open a Purple-Shell, and the process is apt to be infinitely tedious. The seven shells in the example I have given were dealt with in the space of about twenty minutes. In the same time an Oystercatcher can account for seven times seven Mussels with a fraction of the labour expended.

It may be noteworthy that the Oystercatcher appears invariably to carry the shell crosswise in the bill from the place where it was found to the place where it is to be opened, and yet holds it by the outer lip in making any subsequent movements. The relation of the bill to the aperture and the margin of the first opening during the application of force to the shell is also a little obscure. It is clear—in theory, at least—that if the shell be held firmly the under side will be crushed and impaled in the soft parts which are generally refused in that condition by the Oystercatcher. The evidence, however, both direct and indirect, points the other way. When it is hammered the shell does not rise with the bill between two successive blows, and it appears to have a slight mobility independent of the movements of the bill. The fragments are driven out and not inwards, which, in consideration of the mechanical construction of the shell, is by far the better plan. On the assumption that, to produce the desired result, the shell must be held loosely, it would seem simpler and more effective to put the point of the whole bill inside the shell, but I have not been able to assure myself that the Oystercatcher ever does so. At present, I suppose that the lower mandible is kept outside the shell for the express purpose of preventing or arresting any tendency to lateral movement. As long as the shell is rocked in the direction of its length it is perfectly steady, but its behaviour is uncertain whenever the movement takes the line of its shorter axis.