

Letters to the Editor.

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Severe Environmental Mortality among *Abra* (= *Syndosmya*) *alba*, *Donax vittatus*, and other Organisms off the Lancashire Coast.

WHILST walking along the Birkdale sands from Ainsdale to Southport on the Lancashire coast on Nov. 3, I noticed that immense numbers of small molluscs had recently been washed ashore, and as definite observations on environmental mortality are important in connexion with the adaptations of a species to its environment, such occurrences are worthy of record.

The spring tide had begun to ebb as I set out to walk from Ainsdale to Southport along the high-water mark at midday, and my attention was at once attracted by large numbers of tubes of *Pectinaria* and *Lanice* (= *Terebella*) and shells of *Abra alba* (= *Syndosmya*) Wood. The tubes of *Pectinaria* were empty, while those of *Lanice* constituted only the upper portion and, though obviously fresh, like those of *Pectinaria*, were also empty. These tubes occurred along the whole stretch of the sands examined, either in rows or piles, at and near the high-water mark, and the mortality in *Pectinaria* may be estimated to have been of the order calculated for *Abra* below. Probably no or little mortality occurred in *Lanice* owing to the habit of this animal of retreating down its deeply embedded tube at a rapid rate when disturbed. *Pectinaria*, having a cone-shaped tube, cannot retreat in this way and must perforce become exposed when its tube is washed out of the substratum.

Shells of *Abra* were also distributed along the whole of the region of the high-water line from Ainsdale to Southport, either in heaps in stream-lines or in crowded rows along the high-water mark or scattered over a strip of high-water wash-mark varying from about 5 to 10 yards mostly, according to the contour of the high-water region. The shells were entire and fresh, and on the return journey from Southport to Ainsdale it was estimated that from 25 to 50 per cent of them contained either living or recently dead tissue. A sample of the shells with soft parts remaining was examined in the laboratory on the same and following days, when living tissues were found. Living Trematode larvæ were also found in seven or eight individuals out of about 12 or 13 examined, one individual being heavily infected. There can be no doubt, therefore, that the *Abra* as well as the *Pectinaria* and *Lanice* had been washed ashore during a few recent (and spring) tides.

An attempt was made to estimate the number of *Abra* present on the strip of shore examined. In representative areas where the shells were scattered thinly, two counts in about a square foot gave about one in 10 sq. inches. In thicker collections at a typical place at the higher water-line there were about three per 10 sq. inches. In still thicker concentrations of common occurrence there were 20 in 10 sq. inches, and in a typical stream-line collection, of which there were abundance, 25 occurred in 10 sq. inches. Still thicker concentrations occurred where heaps of *Abra*, *Pectinaria*, and *Lanice* occurred to a depth of one to two inches or possibly deeper, but sometimes these heavier concentrations coincided with a sparsely besprinkled high-water zone. On the minimum estimate of a thickness of 14 *Abra* per

square foot for a width of only $7\frac{1}{2}$ yards along the high-tide zone from Ainsdale to Southport (fully three miles were carefully examined), it is easy to estimate that approximately 5 million individuals had been recently washed ashore on this strip of coast. But as shells were also found lower down in the tidal zone, and fishes, gulls, and other animals had in all probability fed on them, in addition to the thicker concentrations observed, it is probable that a more likely minimum estimation of the loss would be of the order of 10 million.

While counting the *Abra* it was observed that countless numbers of the spat of *Donax vittatus* (for the identification of which I am greatly indebted to my friend, Mr. R. Winckworth) occurred also along the high-water line, especially in stranded waves of froth. These also occurred with few exceptions along the greater part of the three miles of shore examined. At some points the spat were scattered over the high-water zone, but close observation was required to detect them, as their size ranged from only about 3 mm. to 4.3 mm. No attempt was made to estimate numbers in the heaped-up masses, but 58 were picked up on a halfpenny where they were lying about one deep. In many places masses of them could be picked up in one's fingers. The loss of the spat of *Donax vittatus* may therefore be estimated conservatively as ten times greater than that of *Abra*, and therefore of the order of 100 million on this strip of coast.

As some food-fishes, for example, plaice, devour *Abra*, *Donax*, and *Pectinaria* (see the work of Todd, Petersen, Ford, Ray, and others), the mortality observed represents perhaps a not unimportant loss of potential fish-food, and demonstrates in the case of *Donax* the manner in which the whole spatfall may fail in certain years even after the critical post-larval stage is overcome.

It seems probable that the mortality was due in this case to a certain wave-action set up by a combination of strong inshore winds coincident with spring tides, whereby is produced a strong groundswell which washes out all organisms in the surface layers of the sandy or muddy sea-bottom. It would appear that this section of the coast is peculiarly liable to disturbance of this kind, as Chaster records immense quantities of the relatively large spiny cockle (*Cardium echinatum*) thrown up alive on the same beach in January 1891 (*Southport Soc. Nat. Hist.*, i. 1892).

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Liverpool, Nov. 23.

Mechanism in Nerve Centres.

MACCURDY, in his stimulating book, "Common Principles in Psychology and Physiology", has assailed the mechanistic interpretation of reflex function as incompatible with known facts. He concedes that the nerve impulse, as exhibited in the peripheral nerve fibre, may be explicable on a physical basis, but he insists that as soon as we encounter the function of the nerve centre, even as exemplified in the simplest reflex arc, we are forced to recognise the presence of something quite apart from any physical mechanism. He contends that the nerve centre does not merely conduct impulses (as does the nerve fibre) but produces them. MacCurdy further objects to the assumption of physical mechanism in the nerve centre on three specific grounds; namely, a machine "cannot change itself or its functions to meet new conditions; it does not improve its performance with practice; it cannot perform some particular function depending originally on one part, after that part is destroyed".

Much has been written on the differences between conduction in the peripheral nerve fibre and in the