tube is used, it is not clear, from the details given, what prevents the tube from being forced up through the sheath by the friction of the entering deposit, and damaging the valve above. 4) Finally, it may be suggested that a very slight thickening of the free end of the sheath would facilitate its penetration of the mud by reducing friction against the proximal part of its walls.

A propeller, fitted to the tail-shaft, conduces to steady rectilinear travel, but in common with other samplers, the taking of a truly vertical boring can only be judged from the appearance of the sample.

J. R. B.

H. B. MOORE. The Muds of the Clyde Sea Area. I. Phosphate and Nitrogen Contents. Jour. Mar. Biol. Assoc., N. S. Vol. XVI, No. 2, pp. 595—607. Plymouth, 1930.

The investigation of the chemical and physical factors which affect life on the sea-floor is a natural extension of the line of research established at the Millport Marine Station, in MARSHALL & ORR'S work (l. c. XIV) on the relation of the plankton to its changing physical environment, in the Clyde Sea Area. Conditions on the bottom, however, are more complex than in the waters, and the author rightly regards this as a preliminary statement which further investigation may modify.

Core-sampling of the muddy deposits was carried out by means of the bottom-sampler described in the preceding note, the core being cut up for analysis into 5 cm. lengths. The phosphate content of the dried material was determined by the phosphomolybdate method, and the total nitrogen by Kjeldahl. Phosphate values from the different stations range between 0.117 and 0.406 % P_2O_5 (on dry weight) in the upper 5 cm., and while nearly all stations show a falling-off in phosphate content at greater depths in the mud, the decline is not continuous — an unexplained kink occurring at 10—15 cms. Apart from this, there is no apparent correlation between actual depth of bottom and phosphate content, and this applies equally to the nitrogen values. A fairly good linear relation exists between % P_2O_5 and % N_2, at all stations, except, as might be expected, in the disturbed upper 5 cm. layer.

The results, while admittedly drawn from too limited and too complex an area to permit of broad generalisation, are a definite step towards an evaluation of the nutritive-cycle between the sea-bottom and the upper waters in the Clyde Sea Area, similar to that which has for so long been shown to exist by PETERSEN, BLEGVAD, and others, in Danish waters.

J. R. B.

D. M. REID. Salinity Interchange between Sea-Water in Sands and Overflowing Fresh-water at Low Tide. Jour. Mar. Biol. Assoc., N. S. Vol XVI, No. 2, pp. 609—614. Plymouth, 1930.

The influence of varying salinity is doubtless one of the most potent factors in the ecology of the sea-shore, and at the same time one of the most difficult to assess. The author has here attempted to determine the

salinity *in situ* at different depths in the sand of a N. Scottish beach, and concludes that the flowing of a fresh-water stream over the surface of an intertidal sand has a negligible effect upon the salinity (and presumably upon the in-fauna) of the interstitial water, at depths in the sand greater than 10 inches. This, however, does not apply to shallow sands with underlying rock, where the washing effect extends, for various reasons, to a much greater depth. An attempt is made to explain the salinity range at successive points between high water mark and low water mark as dependent upon the relative periods of submergence by the tide, but so intimately are salinity and other differences bound up with local topographical detail (contour, sand-grade, impermeable strata, etc.) as well as with hydrostatic effects due to subsurface waters, that no direct correlation would seem to be justified without a full specification of the local data. At the same time, this short investigation, involving only the simplest of technique, is a useful survey of the salinity-conditions in a specified area. It is only by such detailed local surveys that we can hope ultimately to gain a real insight into the complex physical and biological conditions which affect living things on the sea-shore. J. R. B.

A. C. JOHANSEN. The Aalborg Herring and its Importance to the Danish Herring Fishery from the XVIth Century until the Present Day. Report of the Danish Biological Station to the Ministry of Shipping and Fisheries. XXXV. 1929. pp. 3—47. Copenhagen, 1929.

All who are interested in Danish Fisheries are familiar with the Limfjord but probably its past history is not known to many outside Denmark. In the present paper Dr. JOHANSEN traces the changes which, during the past four hundred years, this stretch of water has undergone and the consequent alterations in the habits of the Herring which frequent it. At the present day the Limfjord consists, in its western part, of a number of wide stretches of water, the broads, joined to each other by narrower channels and communicating with the North Sea by a navigable opening, the Thyborøn Canal, which pierces the narrow strip of land, the Agger Isthmus, separating Nissum Broad from the North Sea. The Broads are also connected with the Kattegat by a river-like channel on which Aalborg is situated, which widens midway into the Nibe Broad.

In the XVIth and the beginning of the XVIIth Century the Agger Isthmus formed a continuous barrier between the Limfjord and the North Sea, with the result that the broads formed a series of fresh or slightly brackish inland lakes, discharging into the Kattegat and supporting, as existing records show, a freshwater fauna. The Aalborg channel, through its sea connection, was, however, sufficiently salt to allow of herring making their way up it in such numbers as to support a very valuable fishery.

In 1624 the narrow strip separating the Limfjord from the North Sea was broken through, the salt water invaded the broads and sea fish took the place of the freshwater fish which had perished. The breach in the Agger Isthmus, however, filled itself again after a few years and the broads regained their freshwater fauna, the herring, which had extended their