VON SCHUBERT concludes from these data that all layers between 3500 m. and the bottom — with the exception of those between 4500 m. and 5500 m. — are practically (*praktisch*) in indifferent equilibrium. When the exception between 3500 m. and 4500 m. is mentioned, the expression "stable" would be preferred by the reviewer. If a value of E = + 1.2 is regarded as representing "practically" indifferent conditions, the same holds good also for E = — 0.3.

The author deals further with the opinions of A. DEFANT and W. SCHMIDT concerning the circulation of the water in deeper layers of partly enclosed basins, in relation to the vertical temperature gradient below the minimum level.

An investigation of the whole corrected material of the Snellius Expedition in a manner more thorough than was possible for preliminary reports of the expedition may throw more light on these difficult questions.

v. RIEL.

S. Kokubo and **T. Tamura.** A Quantitative Investigation of the Plankton of Aomori Bay, as Studied Comparatively by Pump and Net Collection. Science Repts. of the Imperial Univ. of Tôhoku. Ser. IV, Biol., Vol. VI, No. 3, pp. 491—531. Sendai, 1931.

The authors studied the seasonal numerical fluctuations and the vertical distribution of the plankton in this relatively shallow bay by means of twelve sets of observations extending over the period Aug. 26, 1930, to Apr. 14, 1931. Collection was by pump and by vertically hauled townets, which were of two kinds (both of No. 25 Müllergaze), the Hensen type and a simpler one in which the mouth was not reduced as in the Hensen. It was assumed that the catches by the pump method were truly representative of the amount of plankton present per unit volume of sea water and these figures were utilised to obtain a measure of the efficiency of the two types of nets. The results obtained in this connexion were of considerable importance. They may be briefly summarised as follows: — In the net of the ordinary type the ratio of the area of mouth to the filtration area was 1:17.7; in the Hensen 1:56. In both cases, however, the efficiency of the net was found to be low, the mean coefficients of filtration for a 30 metre tow being 7.85 (with a probable error of ± 1.46) and 6.26 (with a probable error of ± 1.38) respectively. The coefficients of filtration for both nets shewed a tendency to vary proportionally to the quantity of plankton captured and for the same reason was also proportional to the distance the net was hauled. Selected portions of Table b, p. 520, may be cited to give an idea of the magnitude of the fluctuation.

Observation XII. Hensen Net. April 14. 1931.

Distance of Haul	Actual catch	Filtration coefficient	Distance of Haul	Actual catch	Filtration coefficient
4—0 m.	9.0 cc.	1.57	20—0 m.	12.7 cc.	6.70
8—0 -	14.0 -	2.52	24—0 -	15.6 -	6.95
12—0 -	15.0 -	3.24	26—0 -	17.0 -	7.06
16—0 -	16.0 -	4.29	30—0 -	15.0 -	9.67

These facts led the authors to conclude, p. 530, that "when the nets . . . are towed 30 meters (*sic*) vertically, the filtration coefficients are not only very large but also fluctuate so much as to make impossible the use of these nets for quantitative purposes." They state, too, that in order to obtain an exact result under conditions when the plankton production is in the region of 200 cc. per cubic metre either the ratio of mouth to filtration area should be about 1:300, or that hauls should not exceed 5 metres in length. The variation in efficiency of nets due to clogging has been stressed by other workers but it is unusual to find much importance attached to this source of error. The authors are therefore to be congratulated in boldly stating this important fact anew.

The bulk of the plankton taken in both pump and net collections consisted of such Diatoms as *Chaetoceras spp.*, *Rhizosolenia spp.*, *Thalassiothrix spp.*, etc. The composition, of course, varied with the season of the year. There were well-marked autumn and spring maxima in September and March. The amount of plankton per unit volume was expressed throughout the paper as a volume obtained by allowing the catches to settle in a graduated cylinder. In this connexion the authors state, p. 499, "Looking through the specimens collected from different depths it is remarkable that the specimens taken from 2—4 metres showed a voluminous cottony condition while that of 15 metres gave dense deposition, the two differing markedly from each other. On examining these under the microscope it was found that the cottony sediment is composed of *Chaetoceras* and the dense deposit is mainly composed of such spineless diatoms as *Rhizosolenia*, *Biddulphia* and *Coscinodiscus*." Again on p. 511, there is the comment "Due to scantiness of *Chaetoceras*, the specimen deposited densely." It is highly probable that on this account the amounts of plankton in those cases where the specimen did not pack tightly have tended to be overestimated. Moreover since *Chaetoceras spp.* tended on the whole to favour the upper waters the apparently well-marked abundance of plankton in this layer, which was so obvious in the autumn, may have been somewhat exaggerated.

Using the pump, and filtering 30 litres of water each time from, usually, the following depths 0, 2, 4, 6, 8, 10, 15, 20, 25, and 30 metres the authors were enabled to trace changes in the vertical distribution of the plankton (as a whole) over the period August to April. The results are striking and may be given in the authors' own words, p. 522. ". . . the first two observations (Aug.—Sept.) show clearly that the abundance of plankton is highest in the upper layer and decreases by degrees with depth. In three subsequent observations (Sept.—Oct.), however, the distribution tended to become somewhat homogeneous from the surface to the lower layer. And in the succeeding four observations (Oct.—Jan.) the distribution became really homogeneous throughout the whole layer." Vertical distribution was not studied in February. "But the results of the last two observations (March—Apr.) roughly show a tendency that the lower stratum is more concentrated than the upper stratum."

It is unfortunate that observations were not continued throughout a year and particularly into the early summer when the amount of illumination would be at its maximum.

As regards diurnal changes the authors state in their summary, p. 530,

"As to whether the phytoplankton exhibits any vertical migration due to the change of intensity of light the present data are not determining. But it can possibly be said that such migration is improbable diurnally, but probable seasonally." Since on one occasion only were changes in vertical distribution at different times of day sought for (Oct. 10, 1930) and since here only two series of collections were made, one in the forenoon (8.40—9.30 a. m.) and the other in the afternoon (2.30—3.30 p. m.) this statement is somewhat misleading. The pump method, however, would seem to be particularly well suited to the study of diurnal changes in the vertical distribution since the time required to sample 16 different levels was only 70 minutes (p. 520) and it is to be hoped that perhaps the authors will continue their studies with particular reference to this question.

A. C. G.

S. M. Marshall and **A. P. Orr.** A Study of the Spring Diatom Increase in Loch Striven. Journ. Mar. Biol. Assoc. N. S., Vol. XVI, No. 3, Plymouth, 1930.

Im Loch Striven (Clyde Sea Area, Schottland) wurden 1926 1mal wöchentlich und 1927 und 1928 mit nur wenigen Tagen Zwischenraum Untersuchungen über den Verlauf der Frühjahrs-Diatomeen-Wucherung angestellt. Das Plankton bestand fast ausschliesslich aus *Skeletonema costatum*, welches fast eine Reinkultur in See bildete.

1926 und 1927 begann die Wucherung (1927 schon vor 8. März) an der Oberfläche und setzte sich nach der Tiefe zu fort. Nach etwa 3 Wochen nahm die Zahl der Diatomeen schnell ab, und die Wucherung war beendet. Während der Wucherung vermehrte sich der Gehalt des Wassers an Sauerstoff und pH, während der Phosphat-Gehalt sank. Jedoch hörte die Vermehrung der Diatomeen auf, bevor alles Phosphat verbraucht war, es wird angenommen, dass in diesem Falle ein anderer nicht untersuchter Nährstoff aufgezehrt war. 1928 war der Verlauf der Wucherung unregelmässiger, da durch thermisch bedingte vertikale Wasserbewegungen die Diatomeen-Bestände verschiedener Schichten zeitweise durchmischt wurden. Solche Mischungen können auch durch Wind herbeigeführt werden. In diesem Jahre wurde am 6. April ein neuer Zellen-Typ (grössere und längere Zellen) gefunden, der nach einigen Tagen wieder verschwand.

Durch Versenken von Diatomeen-Kulturen in das Wasser wurde die Intensität der Assimilation (Sauerstoff-Produktion) in verschiedenen Tiefen geprüft. Wenn die Diatomeen an der Oberfläche zahlreich sind, ist die Assimilation schon in geringer Tiefe infolge Beschattung herabgesetzt. Durch weitere Versuche wurde festgestellt, dass eine Beziehung besteht zwischen der durch Permanganat oxydierbaren organischen Substanz und der Menge der Diatomeen. Der Gehalt des Mediums an organischer Substanz nimmt zu mit der Vermehrung der Diatomeen. Der Zeitpunkt für den Beginn der Wucherung wird im Loch Striven hauptsächlich durch die Zunahme der Lichtintensität bestimmt.

KÜNNE.