REPORT

ON

HYDROGRAPHICAL INVESTIGATIONS

IN THE

FAEROE-SHETLAND CHANNEL AND THE NORTHERN PART OF THE NORTH SEA IN 1903,

BY

A. J. ROBERTSON, B.Sc.

CONTENTS.

Page

PART I.—HYDROGRAPHICAL:

Introductory Remarks 53

Apparatus and Methods 53

Method of Analysis 54

Hydrography of the North Sea, 1903 55

Hydrography of the Faeroe–Shetland Channel, 1903 61

Conclusions from the Year's Work 69

PART II.—HYDRODYNAMICAL:

Introductory Remarks 71

Hydrodynamical Conditions of the Faeroe–Shetland Channel, May, 1903 77

Hydrodynamical Conditions of the Faeroe–Shetland Channel, August, 1903 79

TABLES:

Table I.—Deep Water Observations 81

Table 2.—Surface Observations 101

Table 3.—Soundings 113

PLATES IV.—VI.

REPORT

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FAEROE-SHETLAND CHANNEL AND THE NORTHERN PART OF THE NORTH SEA IN THE YEAR 1903.

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A. J. ROBERTSON, B.Sc.

PART I.—HYDROGRAPHICAL.

Introductory Remarks.

Hydrographic work during the year 1903 was greatly interfered with by the weather, which was exceptionally bad throughout. The seasonal cruises in May and August were successfully carried through, but in November, owing to the gales and heavy seas encountered, it was found impossible to work many of the stations in the Faeroe-Shetland Channel. In February the *Jackal* was laid up for an extensive overhaul, and as it was found impossible to obtain another boat of a suitable size, the cruise had ultimately to be abandoned. In August and November the stations south of Shetland were worked by the *Goldseeker*, thus enabling the *Jackal* to devote more time to the Faeroe-Shetland Channel. Lieutenant and Commander Sharp and Mr. W. G. Robson are conjointly responsible for the *Jackal* observations, and they are to be congratulated on the manner in which they conducted their investigations. In addition to the work done during the quarterly cruises, continuous surface observations have been taken throughout the year by the captains of various passenger ships. This branch of the work will be considered later.

Apparatus and Methods.

The course described by Helland-Hansen in his report on the investigations for 1902 has been again adhered to during this year's cruises, the only alterations being in the Faeroe-Shetland Channel, where the positions of the stations have been slightly changed and a few new ones introduced. The apparatus employed was, for the most part, similar to that used in August and November, 1902. The surface samples were collected in a canvas bucket and their temperature taken with a Centigrade thermometer divided in tenths. The new form of Pettersson's water-bottle was used for obtaining samples from the various depths, the temperature being measured by means of a deep-sea thermometer sent down inserted in the water-bottle. The thermometers used for this purpose, which are made by Richter, of Berlin, are constructed of Jena glass, and the scale has a range of 10° C., divided in tenths. The thermometer itself is completely surrounded, as a protection against pressure, by a thick glass wall from within which the air has been completely withdrawn so as to diminish conduction of heat to the upper part of the stem. To increase the sensitiveness of the thermometer the bulb is surrounded by mercury contained in the

outer glass tube. The thermometers generally used register either from +4° C. to +14° C., or from +7° C. to +17° C., but the one used in the deeper parts of the Faeroe-Shetland Channel has a range from −2° C. to +8° C. The depths were measured by passing the wire attached to the water-bottle over a meter-wheel. The new pattern of Pettersson's water-bottle is fitted with a frame for carrying a reversing thermometer, which may either be used instead of the deep-sea thermometer or as a check on the results obtained thereby. The new form of Richter reversing thermometer, which is made of Jena glass and protected in the same way as the deep-sea thermometer, is graduated in fifths, and inside the outer tube there is a Centigrade thermometer divided in degrees, for registering the temperature at which the reading of the broken-off mercury column is made. The reversing apparatus attached to the water-bottle has been used on several occasions and has been found to work satisfactorily, the readings given by the two thermometers agreeing very closely. A new form of water-bottle, for use with the reversing thermometer only, has been devised by Ekman and will probably be largely used in future. It consists of a single brass cylinder in place of the set of concentric tubes used in the insulating form, and a frame rigidly fixed to the side of the cylinder holds the reversing thermometer. The bottle is closed by a messenger, which, on striking, releases a catch causing the bottle and thermometer to reverse together, the bottle becoming quite closed on turning over. The cost of this bottle is low; the chief objection to its use is the time which must always be allowed to enable the thermometer to acquire the temperature of the surrounding water before reversing.

Some interesting soundings were taken with the Lucas sounding machine in the Faeroe-Shetland Channel during the August cruise. An electric motor, which has been fitted up on the *Jackal* for hauling up the water-bottle and plankton nets, was first used in August and was found to work satisfactorily, with a great saving of time and labour, especially at the deeper stations.

Method of Analysis.

The salinities have been determined by the volumetric silver nitrate method, using potassium chromate as indicator. The analyses have been done at the uniform rate of 15 per hour, one titration of standard sea-water being made every hour as a check on the results obtained. This standard water is prepared and carefully analysed gravimetrically at the Central Laboratory in Christiania, being afterwards kept in sealed tubes and sent out as required. The silver nitrate solution used was of such a strength that 38·7 cc. (approx.) were necessary to precipitate the halogens contained in 15 cc. of sea-water of 35 per mille salinity. The pipette used for measuring off the sea-water had a capacity of about 15 cc. and automatically delivered the same volume each time. The burette was of the form described by Helland-Hansen in his report for 1902, and was connected with a large bottle of $5\frac{1}{2}$ litres capacity, being filled automatically from below. The analyses were carried out in an ordinary glass tumbler, and the greater part of the silver solution necessary was run in before the indicator was added. By using the analysis of the standard water as a check, any sources of error which may enter into the method are entirely eliminated and a high degree of accuracy is thereby attained. The actual error of experiment is small, duplicate analyses seldom differing by more than 0·02 per mille salinity.

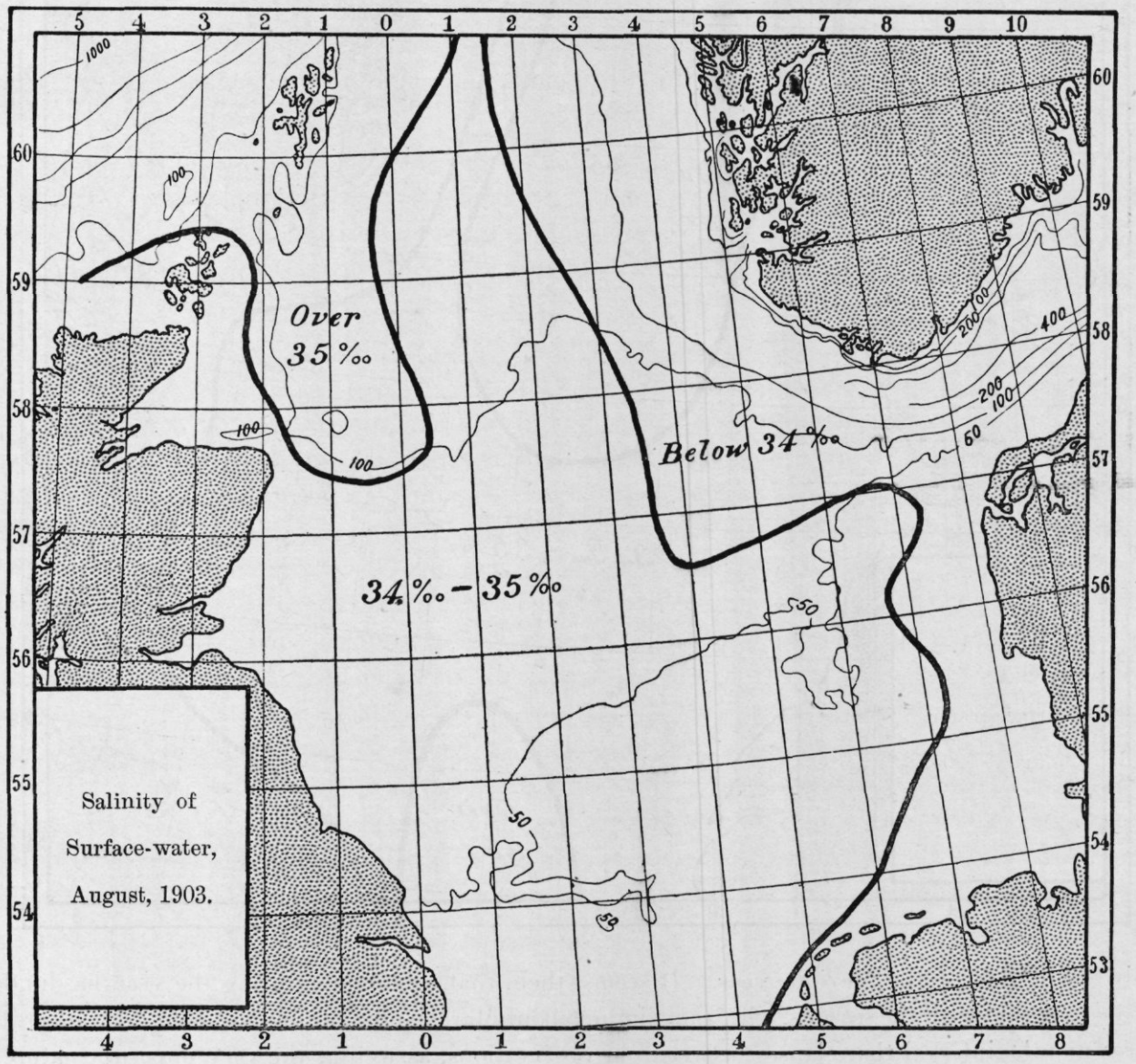
From the salinity results ($S.^{\circ}/_{\circ\circ}$) found, the densities at zero were read off from Knudsen's Tables, and, by combining these results with the observed temperatures, the densities *in situ* (σ_t) for the water at the various depths at the stations were calculated. Table 1 gives a list of the temperatures, salinities, and densities *in situ* of the water at the stations investigated during the quarterly cruises. The temperatures have all been referred to the hydrogen thermometer. The numbers printed in italics, under the heading $v - v^1$ and $E - E^1$, have reference to the hydrodynamical treatment of the question, and will be explained and discussed in the sequel.

THE HYDROGRAPHY OF THE NORTH SEA, 1903.

Aberdeen to Shetland.

Taking the sections in order, the first is that running northwards, from off the Moray Firth to Shetland (*see* Chart, p. 64). Along this line four stations were worked in May, six in August (including a new one in Kinnaird Deep), and five in November. The position of these stations has been specially chosen with a view to investigating the periodic changes in the inflow of Atlantic water into the North Sea between Scotland and Shetland.

Fig. 1.

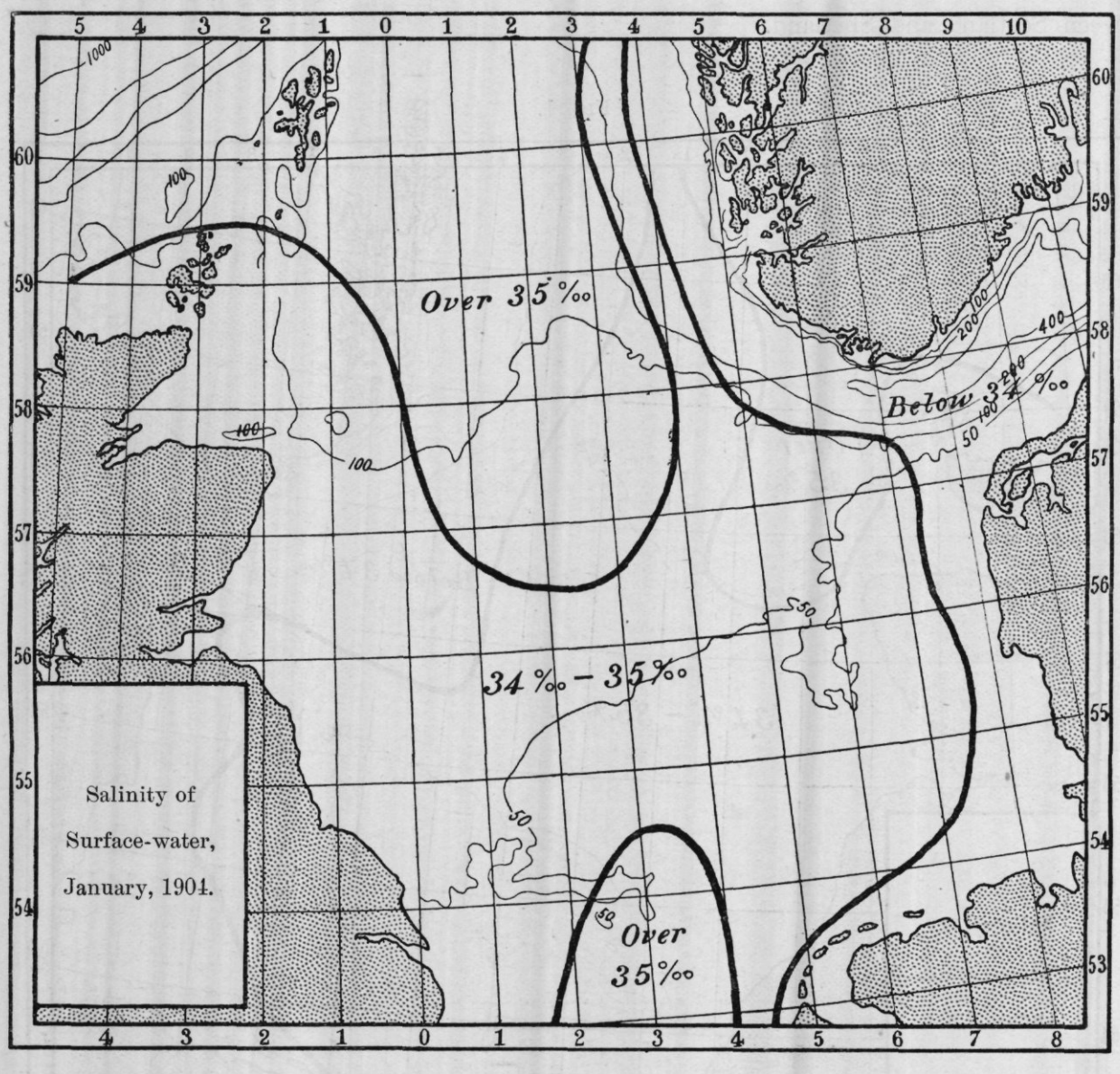


The whole area from Station 2 northwards to Shetland was, in May, flooded by Atlantic water with a salinity of over 35·25 per mille (Pl. VI., 1). In August (Pl. VI., 2) the 35·25 isohaline had moved much nearer to Shetland, although there was still present a considerable quantity of 35·2 per mille water.

The hydrographical conditions for November were quite different from those existing in this part of the sea in May. The salinity of the water was much lower (Pl. VI., 3), most of it being less than 35·15 per mille, while the 35·25 water was only found close to Shetland.

These facts show that the inflow of Atlantic water through these channels south of the Shetlands probably continued to decrease from May onwards, till in November very little entered the North Sea between Scotland and Shetland, and the Atlantic water then found was of considerably lower salinity. By February of this year, 1904, the inflow had recommenced, but was not then quite so

FIG. 2.

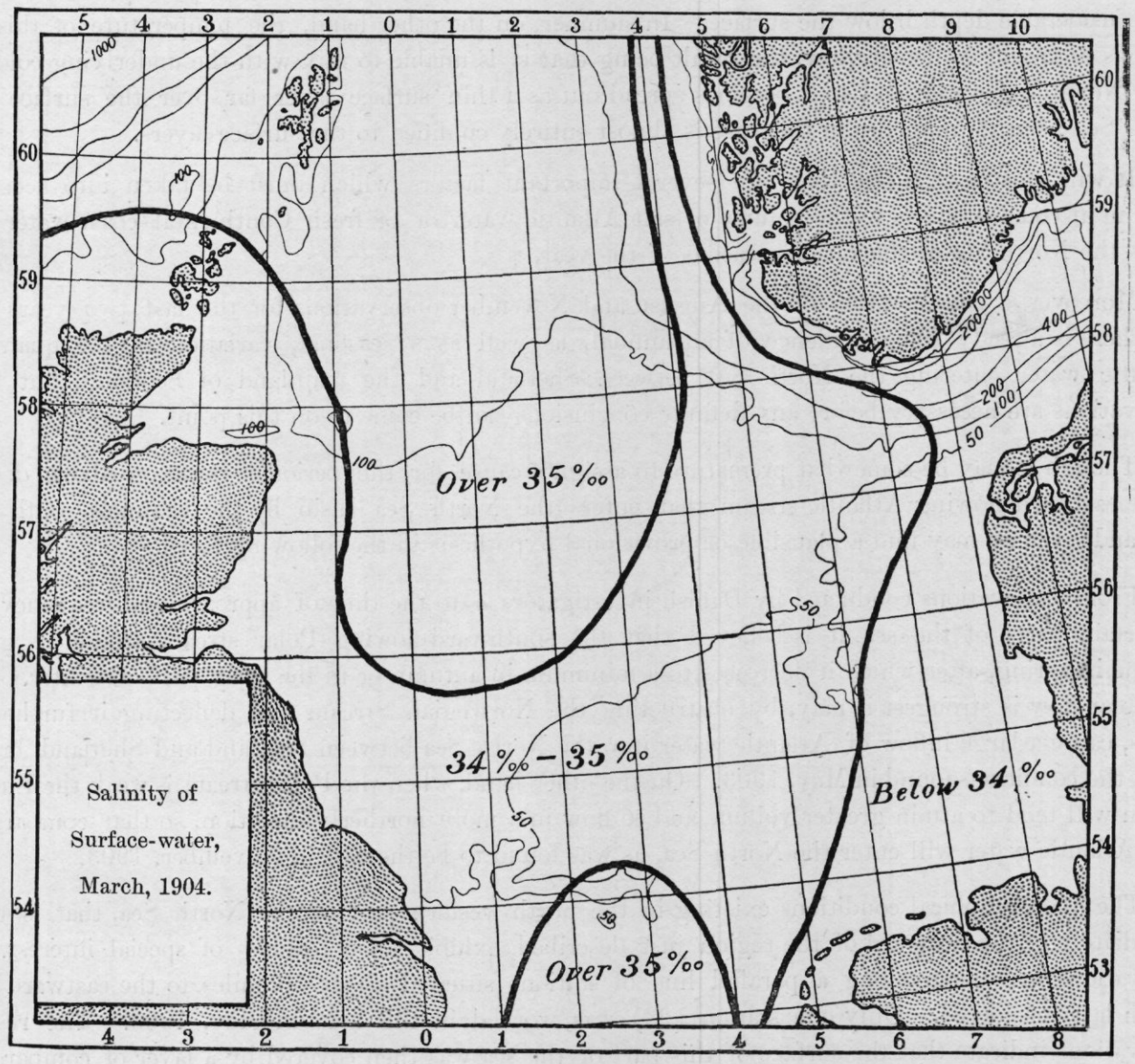


extensive as in May of the previous year. It seems, then, that this inflow during the year has undergone a periodic variation with the seasons, with a maximum about March and a minimum about November, though the three months interval that elapses between our observations, as well as the very imperfect nature of the results of our winter cruises, manifestly leave it somewhat uncertain in what months the actual maximum and minimum take place, and do not exclude the possibility of other undiscovered periodic variations having taken place in the intervals.

This hypothesis is found to be in accordance with the surface salinity of the North Sea, as shown by the observations taken from Newcastle to Stavanger and from Leith to Christiansand by Captains Oxholm and Stark (cf. p. 126). During the whole of 1903 from June onwards the surface salinity was seldom higher than 35·05 per mille, while in February and March, 1904, a considerable area of this part of the North Sea was flooded by surface water of salinity 35·2–35·3 per mille.

The area covered by the highly saline surface water appeared to increase gradually from January onwards till March, and by April had again begun to decrease. In March the surface salinity along the

FIG. 3.



Newcastle-Bergen route from 56° 25′ N – 0° E to 59° N – 3° 30′ E. was as high as 35·2–35·35 per mille. These facts seem to accord with the supposition that the greatest inflow of Atlantic water into the North Sea occurs during winter or early spring.

It must, however, be borne in mind that the surface salinity of the North Sea depends not only on the quantity of Atlantic water entering it, but also on the volume and distributive extent of the Baltic Stream.

This fresh-water inflow is somewhat greater in early spring than in summer, yet its most extensive distribution outwards from the Norwegian Coast occurs during the latter season. This may be, to a certain extent, accounted for by a greater influx of Atlantic water into the North Sea during winter, but there is another and a more powerful factor which must be taken into consideration in connection with this outward extension of the coast-water. In spring the temperature of the Baltic outflow is much lower than the temperature of the North Sea into which it flows, the result being, that although the salinity of this water may be comparatively low, yet its density may be as great as, or even greater than, the density of the North Sea water. In consequence of this, convection currents are set up, and the fresh coast-water becomes mixed up with the underlying salter water in the deep channel off the Norwegian coast, so that its effect on the salinity may then be traced to a considerable depth below the surface. In summer, on the other hand, the temperature of this land-water is high and its density low, the result being that it is unable to mix with the underlying colder and salter North Sea water, and so it becomes spread out as a thin surface layer far over the surface of the North Sea ; but its influence in this case is almost entirely confined to the surface layers.

It will thus be seen that there are several important factors which must be taken into account in arriving at conclusions as to the volume of salt Atlantic water or of fresh Continental coast-water which enters the North Sea at the various seasons of the year.

Moreover, a consideration of the August and November observations for the last two years shows that there is already some evidence of an annual, as well as a seasonal, variation in the quantity of Atlantic water entering the North Sea between Shetland and the mainland of Scotland, but further observations are necessary before any definite conclusions can be come to on this point.

Though it may be somewhat premature to assign a cause for the periodic variation above described in the eastward flowing Atlantic stream that enters the North Sea basin by the channels south of the Shetlands, yet we may find a plausible or provisional hypothesis in the following facts.

From observations conducted by Danish investigators as to the time of approach and frequency of ice in certain parts of the sea, it is believed that the southward-flowing Polar stream attains its greatest volume in spring, after which it decreases to a minimum in autumn or in the early part of winter. When the Polar flow is strongest it may, by obstructing the Norwegian Stream and deflecting it further eastwards, cause a large inflow of Atlantic water into the North Sea between Scotland and Shetland, bringing about the conditions found in May, 1903. On the other hand, when the Polar stream is weak the European stream will tend to attain greater volume and to flow in a more northerly direction, so that comparatively little Atlantic water will enter the North Sea, as was found to be the case in November, 1903.

The hydrographical conditions existing in the north-western part of the North Sea, that is to say, immediately to the eastward of the region just described, exhibit some features of special interest. The observations are taken along a parallel line of stations situated about 50 miles to the eastward of the section last considered. Only one station (23) was worked in this area in May, 1903. The resulting observations indicate that the surface of this part of the sea was then covered by a layer of comparatively warm and fresh water, underlying which was a body of uniformly cold and salt water, the salinity and temperature of which agreed pretty closely with those of the water found at Stations 4 and 5 (of the last section), situated about 50 miles to the westward, between Fair Isle and Shetland. From the August observations it was found that at each of the three stations worked (23, 24, 25), the temperature and salinity underwent a sudden change at 50 metres depth, the limit between the upper and lower water layers being very sharply defined (Pl. VI., 4). From the surface down to 50 metres the temperature of the water was high and the salinity low, indicating a fairly large admixture of Continental coast-water from the

Baltic, which during this month extended far out from the Norwegian coast over the surface of the North Sea. The water from 50 metres downwards was much colder and salter, the temperature remaining constant at 6°·8 C. and the salinity at 35·26 per mille. The bottom layer was, of course, much denser than the upper layer, as the following figures show, the difference of density in the neighbourhood of 40 metres being so great as to prevent the likelihood of rapid mixture.

NORTH SEA STATION 23 (59° 31′ N.–0° 37′ E.).

August, 1903.

Depth.	Temperature °C.	Salinity.	Density *in situ*.
0 metres	12·40	34·66	26·264
20 „	12·27	34·73	26·347
40 „	10·33	35·19	27·062
50 „	6·92	35·26	27·660
100 „	6·79	35·26	27·677

In November this water was found only below 80 metres depth, and there was not then nearly so much difference in density between the top and bottom layers (Pl. VI., 5). Throughout the year the salinity and temperature of this bottom water have remained practically constant, as may be seen from the following observations apply to water taken from 80 metres depth at Station 23 (59° 31′ N.–0° 37′ E.) throughout the year 1903 :—

STATION 23 (80 METRES).

—	Temperature °C.	Salinity °/₀₀.
May, 1903	7°·02	35·29
August, 1903	6°·77	35·26
November, 1903	7°·10	35·28

It is evident that we are dealing in this region with two quite distinct bodies of water. The superficial layer, as we have said, is to be simply explained as North Sea water, of mixed origin, with its salinity lowered (at certain seasons of the year) by Baltic overflow. But what is the probable source of the cold salt water of the lower layer ? It is too cold to be summer Atlantic water, and too salt to be Polar water. Two alternative explanations present themselves to us.

It may be that this bottom water was of direct Atlantic origin, part, that is to say, of the normal inflow between Scotland and Shetland, cooled down after its entry into the North Sea during the previous winter. On the other hand, it may be water, indirectly of Atlantic origin, but coming directly from the Norwegian Sea, water that had first passed up there from the Atlantic, been cooled down in more northern latitudes, and then moved southwards into the North Sea in the form of an undercurrent, having dipped, that is to say, beneath the warmer northward moving waters of the European Stream.

The question is of considerable hydrographic interest, and may be connected with other questions of practical importance ; for there can be little doubt that this cold water is markedly distinct in its

relations to the bottom fauna from the sharply marked off warmer waters to the south and west. The question has been discussed already by Helland-Hansen in the preceding paper (p. 22), and is not yet ripe for solution. We may here merely indicate briefly some facts that seem to bear towards one or other of the two alternative hypotheses.

Unfortunately we have no Scottish observations for February, 1903. A glance at the surface temperature chart for that month* shows, however, that the Atlantic water to the westward of the Scotland–Orkney–Shetland Section was of somewhat higher temperature than 7° C., ranging from 8°–9° C. If, then, the water found in the deeper layers of the north-western part of the North Sea in May consisted of water which had come during the previous winter direct from the Atlantic through the channels between Scotland and Shetland, it must have become cooled down after entering the North Sea basin. The water over the greater part of the North Sea was, in February, 1903, of a temperature less than 7° C., so that Atlantic water of 8°–9° C. entering the North Sea basin and remaining there would very soon acquire a considerably lower temperature. Moreover, from a consideration of this year's results, it seems probable that the Atlantic inflow through the channels south of the Shetlands *is*, in winter, strong enough to flood the north-western part of the North Sea. In February, 1904, the greater part of this area was actually flooded by water of a temperature of 7° C. and salinity of about 35·2 per mille, both of which factors remained nearly constant from surface to bottom. When, however, this influx of Atlantic water begins to fall off, it seems possible that this salt water, which, in winter, floods the north-western part of the North Sea, may remain in a comparatively stationary condition between the northward-moving Atlantic water, and that tongue of Atlantic water which bends southward by the Scottish coast into the North Sea, being, throughout the year, gradually mixed and diluted from above with less salt Atlantic water or with Continental coast-water. The gradual diminution in the volume of this cold salt water from May onwards could not, however, be altogether accounted for by this gradual mixing, which owing to the great difference in density between the top and bottom layers would take place only very slowly. It is more probably gradually driven eastwards by the continued inflow from the Atlantic, and may ultimately make its way into the deep channel off the Norwegian coast, or even into the Skagerrack itself. In May this cold salt bottom water was found at Station Sc. 'G' 6 (59° 25′ N.–1° 48′ E.), and also at Stations D. Nordsee 6 (57° 50′ N.–4° 47′ E.), D. Nordsee 7 (58° 08′ N.–5° 19′ E.), and D. Nordsee 10 (57° 31′ N.–7° 36′ E.), but not at Station Sc. 'G' 7 (58° 52′ N.–1° 22′ E.), nor at D. Nordsee 4 (56° 41′ N.–2° 15′ E.), and D. Nordsee 5 (57° 24′ N.–3° 42′ E.). These facts show that this water was then moving, not in a southerly, but in an easterly direction, indicating, apparently, that it had come from the Atlantic through the channels south of Shetland, and that part of it was, moreover, during that month, actually passing into the Skagerrack as an undercurrent.

On the other hand, this particular cold water in the north-western part of the North Sea may, at some time previous to that at which it was found, have moved southwards as an *under-current* from the central or western parts of the Norwegian Sea. There is difficulty in accepting this explanation from the fact that water moving as an *under-current* would not so readily be cooled down to a temperature of 7° C., and also from the fact that no water of this temperature and salinity existed in May at Station Sc. 'G' 7, indicating, as explained above, that this water was more likely moving towards a more easterly, rather than a more southerly, region.

Shetland to Norway.

The line of stations next to be considered (Nos. 6, 7, 8) runs in a north-easterly direction from Lerwick towards the Norwegian coast. The observations at Station 6, which is situated nearest

* Bulletin des résultats acquis pendant les courses périodiques, No. 3: Fevrier, 1903. Pl. v. and vi. Copenhague, 1903.

Shetland, indicate that the water present there throughout the year (Pl. V., 1, 2, 3.) was purely Atlantic in character, diluted, perhaps, to a slight extent with coast-water from the Shetlands. The conditions prevailing at Station 7 were very similar except in August, when the fresh-water outflow from the Baltic extended far enough westward to influence the temperature and salinity at that station to a depth of 20 metres, the surface salinity falling as low as 33·6 per mille. Station 8, the most easterly point investigated by Scotland, lies within the deep channel off the Norwegian coast, and is situated far enough eastwards to furnish an indication as to the seasonal variation and distribution of the fresh-water Baltic stream, which, owing to the rotation of the earth, continues to flow northwards as a surface-current along the coast of Norway. Whilst the distribution outwards from the Norwegian coast of this fresh water seems to be influenced by the volume and strength of the flow of water from the Atlantic, the main factors on which it depends are the volume and density of the Baltic stream itself. The volume of this fresh-water inflow is greatest in early spring, and it might consequently be expected that its effect on the surface salinity of the North Sea would then be more marked than at any other season of the year. But it is at that season also that the greatest inflow of Atlantic water into the North Sea appears to take place, and this tends to confine the Baltic stream to the regions near the Norwegian coast, and to prevent it spreading out over the surface of the North Sea. Moreover, as already mentioned, the high density of this coast-water in winter gives rise to convection currents, which assist in mixing it up with the salter but warmer underlying layers, so that its effect is confined to a smaller area but extends to a much greater depth downwards. Owing to these causes the distribution westward of this Continental coast-water was much more marked in August, 1903, than in November. In August the salinity at Stations 7 and 8 was very low, but the effect was chiefly confined to the surface layers; in November the surface salinity was hardly affected, even as near the Norwegian coast as Station 8. The surface salinity at Station 7 was, in August, only 33·57 per mille, and at Station 8, 30·3 per mille, while in November the corresponding salinities were 35·30 and 35·14 per mille. The temperature at Station 8 was usually very irregular, being high in summer and low in winter, this effect being due to the influence of the coast-water present there.

The water which underlay this fresh surface layer consisted of Atlantic water diluted by the coast-water from above, the maximum salinity being found at a depth of from 100 to 200 metres, after which it again decreased gradually towards the bottom. This lowering of salinity in the deeper layers, accompanied by a falling off in temperature, was probably due to cooling and admixture with Polar water from higher degrees of latitude.

The course next continues to run from Station 8 in a westerly direction as far as the North of Shetland, this section including Stations 8, 9, 10 and 11. The observations over this area (Pl. V., 4, 5, 6.) show that the entrance from the Norwegian Sea to the North Sea was, during the past year, flooded by Atlantic water as far eastwards as 2° E. longitude, this Atlantic water marking the northward flow of the Norwegian stream. The temperature and salinity at the deeper stations along this line showed a slight falling off towards the bottom, this being evidently due to the same cause as in the former section. The surface salinity at Station 9 was usually affected by the Continental coast-water from the Baltic, but this effect was entirely confined to the surface.

THE HYDROGRAPHY OF THE FAEROE-SHETLAND CHANNEL.

Coming now to the hydrography of the Faeroe-Shetland Channel, a few introductory remarks may first be made with regard to the various bodies of water which must be taken into account in discussing the hydrographic conditions in this area of the sea.

In the Faeroe-Shetland Channel we have to deal with the opposing movements of waters from the north and from the south. The southward-moving currents are of two kinds. The first of these, the Polar stream, is derived from the melting of ice in Arctic regions; it is characterised by low

temperature and comparatively low salinity, the salinity and temperature gradually increasing as the current moves southward. North of Greenland the Polar current splits into two branches, one of which, the East Icelandic Polar current, passes along the east coast of Iceland and makes its way into the region north of the Faeroes. It there encounters the opposing influence of the flow of water from the Atlantic, and, being unable to penetrate as far south as the Faeroe-Shetland Channel, bends round and passes back towards the north again. That the cold Polar water very rarely reaches so far south as the Faeroes is shown by the fact that no Arctic species of plankton have ever been found in the regions round those islands. The other southerly flow is due to the movement into lower degrees of latitudes of water from the central and western areas of the Norwegian Sea. When the conditions are favourable this water makes its way southwards and enters the Faeroe-Shetland channel, usually as an undercurrent. But, the southward movement into the Channel of this water from the Norwegian Sea is usually prevented by the opposing flow from the Atlantic, except at depths greater than about 550 metres, below which point the Atlantic inflow through the Channel is shut off by the Wyville-Thomson ridge. The southerly limit to which the Norwegian Sea water can extend before sinking under the warmer and lighter Atlantic water naturally depends on the volume and strength of the Norwegian Stream. These two southward-moving bodies of water are quite distinct and separate, and should in no way be confounded the one with the other.

The northward-moving currents are also of two kinds, viz., drift currents, produced at the surface by local winds, and a stream current, which Dickson proposes to call the Norwegian branch of the European stream.* This stream current which flows in from the Atlantic is the great opposing agency to the southward movement of water into the Faeroe-Shetland Channel. The volume and strength of the Norwegian Stream appear to vary not only from season to season but from year to year. Its volume appears to be subject to irregular variations, and to vary greatly in different years. Recent evidence has shown that the Norwegian Stream passes the Faeroe Islands flowing in an almost easterly direction, and that it crosses the Channel from the Faeroes towards the Shetlands in a direction nearly parallel to the Scottish lines of stations. During its progress across the Channel it appears to assume a more or less serpentine course, causing it to cross and recross the southern line of stations. This may probably account for the lower salinity which is usually found in the centre of the southern area of the Channel, and for the apparent division of the Norwegian Stream into two branches, which a study of the section for that region shows. Near Shetland the Norwegian Stream curves round and flows in a northerly direction across the northern line of stations, finally passing away in a north-easterly direction towards the Norwegian coast.

A consideration of these facts shows that unless the volume of the Norwegian Stream be abnormally great it may be possible for water from the western part of the Norwegian Sea to move so far southwards as to penetrate the central part of the northern area of the Channel, afterwards sinking underneath the Atlantic stream and entering the southern part of the Channel as an undercurrent. These facts also explain why the salinity in the western part of the Channel near the Faeroes is usually considerably lower in the northern than in the southern section. When, as happened in August and November, 1903, the eastward flow of Atlantic water passes *south* of the Faeroes and continues to flow for some distance *along* the southern line of stations, then the salinity there is naturally higher than in the more northerly region, where there is no opposing Atlantic stream to prevent the Norwegian Sea water from making its way southwards into the western part of the Channel near the Faeroes. Both these causes, absence of Atlantic Stream water and presence of Norwegian Sea water, naturally tend to lower the salinity in the more northerly regions of the Channel.

With these preliminary remarks, we now turn to a consideration in detail of all the data available in connection with hydrographic work in the Faeroe-Shetland Channel during 1903. From the

* Usually referred to throughout this paper as the Norwegian Stream ; cf. H. N. Dickson, *Phil. Trans.*, A., vol. 196, p. 113 ; *Geograph. Journ.*, April, 1903, p. 421.

Jackal observations we have May and August sections for the northern and southern parts of the Channel, but it is unfortunate that there are no February observations, and only very few for November.

FAEROE-SHETLAND CHANNEL, MAY, 1903.

Taking the sections in order, the first are those representing the northern and southern regions of the Channel in May, 1903 (Pl. IV., Figs. 1, 2). The stations now worked are 13 in number, and lie along two parallel lines, seven stations (12, 13 A, 14 A, 15 A, 15 B, 16 A, 16) being included in the northern section, and six (17, 18 A, 19 A, 19 B, 20 A, 21 A) in the southern.

The hydrographic conditions in the Faeroe-Shetland Channel were, in May, 1903, very similar to those existing there in December of the previous year. The Channel from about 500 metres downwards was filled with cold water of less than 35 per mille salinity ; the salinity of this water remained constant at about 34·90 per mille from about 550 metres to the bottom. The characteristics of this water were exactly similar to those of the water found all over the bottom of the Norwegian Sea. It is evident, then, that the bottom of the Channel was, in May, filled with water which had moved southwards from the Norwegian Sea, and having sunk below the northward-moving Atlantic water had entered the Faeroe-Shetland Channel as an undercurrent, being assisted in so doing by the cutting off at depths greater than 550 metres of the Atlantic inflow by the Wyville-Thomson ridge.

In the southern section the cold underlying water became banked up in the centre of the Channel in the form of a wedge (Pl. IV., Fig. 2), causing the Norwegian Stream to be apparently divided from beneath into two branches, the smaller of which flowed in the centre of the Channel. The following temperatures illustrate this "banking-up" of the cold water in the centre of the southern part of the Channel.

FAEROE-SHETLAND CHANNEL. SOUTHERN SECTION, MAY, 1903.

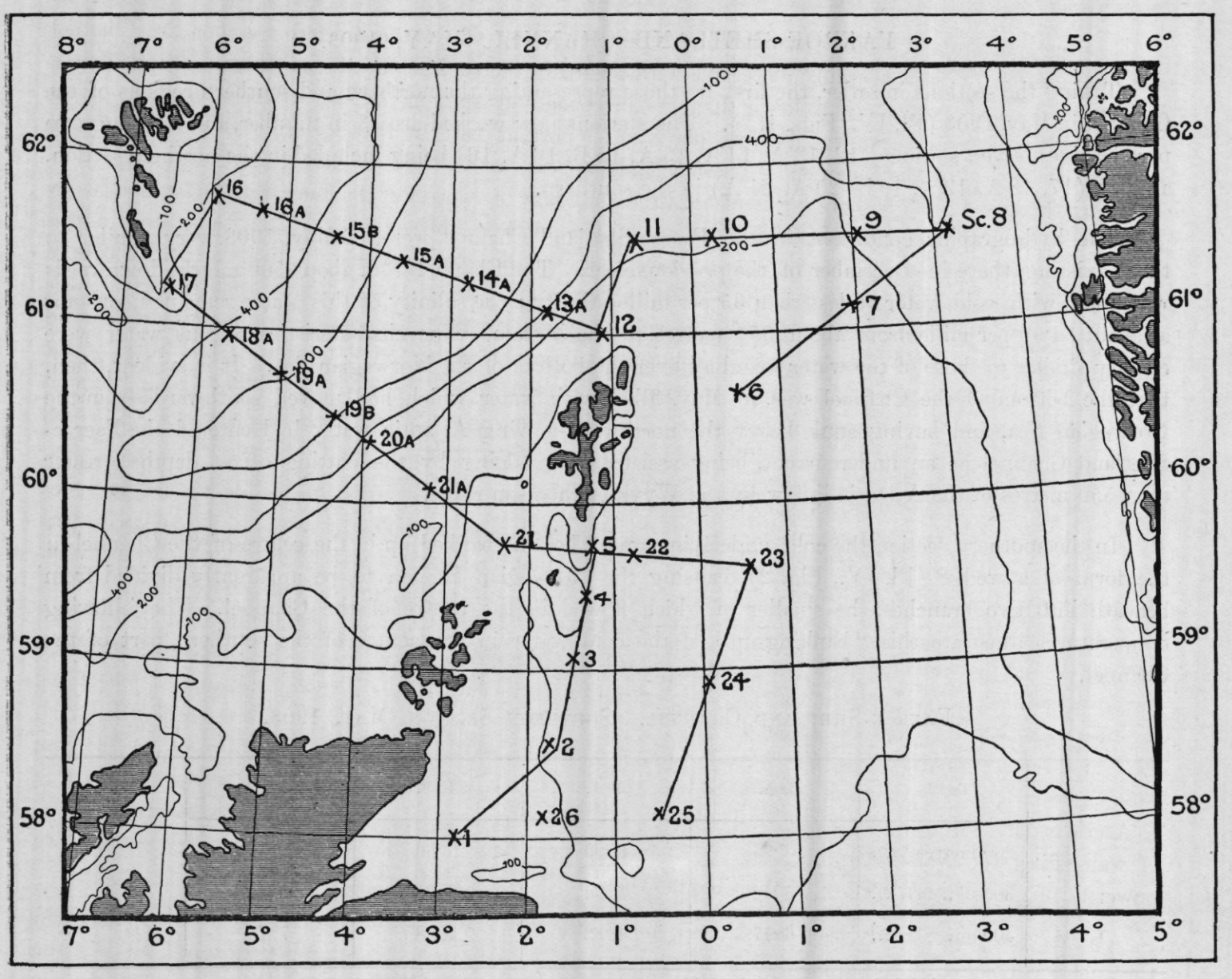
Depth.	18 A.	19 A.	19 B.	20 A.
200 metres ...	6°·95	6°·99	6°·86	8°·30
300 „ ...	6°·42	5°·92	6°·25	8°·22
400 „ ...	6°·17	4°·82	4°·68	7°·70

The probable explanation of this phenomenon is, as has been suggested by others, that the southward moving Norwegian Sea water becomes banked up against the Wyville-Thomson ridge, being then drawn up by the "undertow" of the overlying Atlantic stream, so that it assumes a higher level in the more southerly regions of the Channel.

In the southern area of the Channel the Norwegian Stream was, as has already been mentioned, apparently divided into two branches, the salinity at Station 19 A. in the centre of the Channel being slightly lower than at corresponding depths to east or west of it. As has been suggested above, this division of the Norwegian Stream may have been caused by the banking up of the underlying colder and less saline water against the Wyville-Thomson ridge.

The Atlantic inflow appears to have had its most extensive distribution for the year over the surface of the sea near the Faeroe-Shetland Channel in the month of May. The 35·25 isohaline for that month passed in an easterly direction considerably to the north of the Faeroes, nearly the whole area in and around the Faeroe-Shetland Channel being then flooded by water exceeding that limit of salinity. North of the Shetlands, the 35·25 line turned abruptly northwards, indicating that the Norwegian Stream had changed to a more northerly direction in the eastern part of the Channel. A wedge of 35·4 per mille water

crossed the Channel in a north-easterly direction, passing close to the Shetlands, which seemed to be more or less completely washed by it.



SCOTTISH HYDROGRAPHIC STATIONS, 1903.—SCALE 1 :—4,000,000.

Another possible explanation of the lower salinity at Station 19 A. in the centre of the southern section of the channel is, that owing to the winding course followed by the Norwegian Stream this station may have been situated in a position where the full effect of the Atlantic inflow was not experienced. If this be the true explanation, then the apparent division of the Norwegian Stream into two branches does not really exist.

A study of the northern and southern sections for May shows that the Norwegian Stream then extended to a depth of about 500 metres in the eastern part of the Channel. The Atlantic inflow through the Channel during this month appeared to move in a more northerly direction than was found to be the case during the following August and November, so that the Norwegian Stream made its influence more felt in the northern section of the Channel. During these two latter months it entered the Channel to the *south* of the Faeroes flowing in an almost easterly direction, so that it only flooded the northern part of the Channel near the eastern side, close to the Shetlands.

During May a certain Diatom, *Cerataulina Bergonii*, Perag., characteristic of the coast waters of Shetland was found in the plankton hauls at nearly all the stations to the north-east of the Shetlands, showing that it had been carried out to these localities by the north-easterly flow of the Norwegian

Stream. In August, on the other hand, this shore form was almost entirely absent from the same stations, the inference being that the Shetlands were in May more thoroughly washed by Atlantic water and that the inflow in that part of the Channel was then running in a north-easterly direction.

The temperature and salinity usually show a decided falling off in the western part of the Channel near the Faeroes. This is specially noticeable with regard to the stations in the northern section, where the salinity is usually considerably lower than at corresponding stations in the southern section. It is unlikely that coast-water from the Faeroes plays an important part in this lowering of the salinity in the western region of the Channel. These islands appear to be more or less completely washed by oceanic water, and although shore forms of life were abundant in August at the more westerly stations, they might easily have been carried out there by the flow of water from the Atlantic. The same shore forms were not found at these stations in May ; either they had not yet appeared in their natural course of development or else the direction of flow of the Norwegian Stream was at that time slightly more northerly near the Faeroes than was the case in August, so that the coast organisms were washed outwards in a northerly direction and consequently were not to be found in the western area of the Channel. The mere fact of these coast species having been found at Stations 16 and 17 in August is a strong argument in support of our belief that the Norwegian Stream in that part of the Channel was then running in an almost easterly direction toward the Shetlands.

The lowering of salinity in the western part of the Channel is in all probability due to the presence there of water from the Norwegian Sea, which is apparently able to make its way as far south as the Faeroes in the western part of the Channel. This explanation, taken in conjunction with the fact that the Norwegian Stream usually runs more or less in a direction along the southern line of stations, would account for the fact that the salinity in the western part of the Channel is generally highest in the southern section. Strong evidence in support of this theory is furnished by a consideration of the plankton results. Arctic species are entirely absent around the Faeroes. Ostenfeld had surface collections taken at various points near these islands from 1897–1900, but found no Arctic forms present in the hauls. The same remark applies to the *Jackal* collections for 1903 examined by Clark. These facts show that the Polar Stream does not penetrate as far south as the Faeroes, so that the lowering of salinity cannot be due to Arctic water. Moreover, the plankton evidence furnishes strong proof of the presence around the Faeroes of water from the Norwegian Sea, and the effect of this water on the salinity would be much more powerful in the northern section of the Channel than in the more southerly regions.

In May, as has already been mentioned, nearly the whole area in and around the Faeroe-Shetland Channel was flooded by water exceeding 35·25 per mille salinity. An exception to this is found in the western area of the Channel near the Faeroes, where the salinity varied from 35·13 per mille in the northern section to 35·16 in the southern. This lowering of the salinity in that region was, as stated above, in all probability due to the presence there of Norwegian Sea water which had moved southward from higher latitudes. The difference between the salinity of the water at the northern and southern stations near the Faeroes was not nearly so great in May as in August. The explanation of this probably is that there was then a much larger quantity of salt Atlantic water in the region around the Faeroes, so that the influence on the salinity, of the Norwegian Sea water was not so greatly felt ; and, moreover, the presence during May in the northerly part of the Channel, of the eastward-flowing Atlantic stream, would tend to obstruct the southward movement of water from the Norwegian Sea to a greater degree than would be the case in August.

FAEROE-SHETLAND CHANNEL, AUGUST, 1903.

The observations for August indicate that very considerable changes had taken place in the hydrographic conditions of the Faeroe-Shetland Channel since the previous investigation in May (Pl. IV., 3, 4). The cold water of less than 35 per mille salinity which filled the greater part of the southern section of the Channel in May had meanwhile been replaced by considerably warmer and salter water, the salinity of

which in no case fell below 35 per mille, while the temperature even at the bottom was as high as 1·7° C. This fact is of great interest, as it shows that important hydrographical changes may take place in the great depths of the Channel within a period of three months, so that the movement of the deeper water-layers must be comparatively great.

The upper layers were found to consist, in the southern area of the Channel, of salt Atlantic water which extended the whole way from the Faeroes to the Shetlands, and which reached a maximum depth of about 400 metres in the centre of the Channel. The Norwegian Stream was, in fact, running more nearly parallel to the southern line of stations in August than had been found to be the case in May. It again appeared to be divided into two branches, the salinity and temperature at Station 19 B being somewhat lower than those at corresponding depths to east or west of this station, as the following observations show :—

FAEROE CHANNEL, SOUTHERN SECTION, AUGUST, 1903.

Depth.	19 A.		19 B.		20 A.	
	Temperature.	Salinity.	Temperature.	Salinity.	Temperature.	Salinity.
0 metres	11·72°	35·36°/$_{oo}$	10·91°	35·26°/$_{oo}$	11·25°	35·42°/$_{oo}$
100 „	9·44°	35·33°/$_{oo}$	8·58°	35·26°/$_{oo}$	9·25°	35·38°/$_{oo}$
200 „	9·09°	35·35°/$_{oo}$	7·55°	35·24°/$_{oo}$	9·15°	35·36°/$_{oo}$

The Norwegian Stream appeared, in August, to be again running strongly both in the northern and southern sections of the eastern area of the Channel, the presence of salt warm Atlantic water being strongly marked in both these lines at the more easterly stations. In all other respects, however, the two sections for August entirely differ. The bottom part of the northern area of the Channel was filled with water of less than 35 per mille salinity from 300 metres downwards, the temperature at 1,000 metres depth falling as low as − 0·7° C., or 2·5° C. lower than at the corresponding depth in the southern section during the same month. Moreover, that part of the Channel from the surface down to 300 metres, which in the southern region of the Channel was found to be filled with salt Atlantic water, was, in the more northerly area, occupied by colder and much less saline water. The following table will show how great were these differences ; Station 14 A is situated in the centre of the northern line of stations and Station 19 A in the centre of the southern line :—

FAEROE CHANNEL, AUGUST, 1903.

Depth.	Northern Section. Station 14 A.		Southern Section. Station 19 A.	
	Temperature ° C.	Salinity °/$_{oo}$.	Temperature ° C.	Salinity °/$_{oo}$.
0 metres	10·97	35·19	11·72	35·36
100 „	7·83	35·23	9·44	35·33
200 „	6·95	35·19	9·09	35·35
300 „	5·22	35·07	8·60	35·33
400 „	1·66	34·87	7·47	35·22
500 „	0·63	34·90	5·36	35·07

We have, then, to find an explanation of the following facts which arise in connection with the hydrographic investigation of the Faeroe-Shetland Channel during August, 1903 :—

(1). No water of 35·3 per mille salinity was, in August, found along the northern section, although it existed in the southern section in very considerable volume.

(2). No water of less than 35 per mille was found in the southern section, although it completely filled the northern part of the Channel from 300 metres downwards.

(3). The temperature and salinity in the centre of the southern area of the Channel were considerably lower than at the stations immediately to the east and west.

(4). The salinity showed a decided falling off in the western part of the Channel near the Faeroes, and was much lower in the northern than in the southern section.

The most satisfactory explanation of these remarkable differences is to be found in the direction of the limit between the waters of northern and of southern origin, that is, between water which has moved southwards from the Norwegian Sea and water which has entered the Channel from the Atlantic. A consideration of the facts set forth in the introductory remarks upon the Faeroe-Shetland Channel will make this clear. The Norwegian Stream apparently flowed into the Channel in an easterly direction so as to pass *along* the southern line of stations, assuming, in its passage from west to east across the Channel, a more or less winding course. This would explain why, if Station 19 B were situated in a position where the full force of the Atlantic flow was not experienced, the temperature and salinity of the water at that point were considerably lower than was the case at the neighbouring stations on either side. Possibly the "banking-up" effect of the colder underlying water, caused by the Wyville-Thomson ridge, may really tend to separate the Norwegian Stream from below into two branches, but the first explanation appears to be the more probable one.

The Norwegian Stream again turned in a northerly or north-easterly direction on approaching the eastern side of the Channel, and continued its flow northwards close to the Shetlands. We thus see that, in the northern area of the Channel, the Atlantic flow was confined almost entirely to the Shetland side ; the salinity of the water composing it was slightly lower in the northern part, the water being evidently more spread out and slightly diluted.

The fact that the Norwegian Stream was flowing *along* the southern line of stations, so that it only crossed the northern line in the eastern part of the Channel would also account for the lower salinity in the more northerly area of the Channel near the Faeroes ; a comparison of the temperatures and salinities at the most westerly stations in the northern and southern areas of the Channel is interesting in connection with this point :—

FAEROE CHANNEL, AUGUST, 1903.

Depth.	Northern Section. Station 16 (62° 00′ N.—6° 12′ W.)		Southern Section. Station 17 (61° 12′ N.—6° 33′ W.)	
	Temperature °C.	Salinity °/₀₀.	Temperature °C.	Salinity °/₀₀.
0 metres	9·45	35·14	9·92	35·26
100 „	9·02	35·14	8·75	35·28

Thus, although Station 17 has a more westerly situation and lies nearer the Faeroes than Station 16, the effect of the Atlantic inflow was, in August, much stronger at the more southerly station, showing

that the Norwegian Stream entered the Channel flowing, not in a north-easterly, but in an almost easterly direction. The fact of shore forms of plankton being then found at these stations, to which they had been carried out from the Faeroes, is further evidence in support of this assertion.

There was, in August 1903, a strong southward movement of Norwegian Sea water into the northern region of the Faeroe-Shetland Channel; this southerly movement apparently took place at all depths, except in the eastern part of the Channel where it encountered the force of the northward-flowing Norwegian Stream. From 300 metres to the bottom the northern part of the Channel was filled with the usual cold 34·9 per mille water, which is found in the deeper layers all over the Norwegian Sea basin. The great bulk of the water which flooded the upper 300 metres varied in salinity only from 35·20 to 35·25 per mille; this surface water was evidently also Norwegian Sea water, mixed, perhaps, with a little Atlantic water. On making its way into more southerly regions, this surface water would be compelled to sink under the lighter water of the Norwegian Stream, and so would enter the southern area of the Channel as an undercurrent. The presence in the deeper parts of the southern section of a certain proportion of this fairly salt warm surface Norwegian Sea water, which was present in large quantity in the upper layers in the more northerly region of the Channel, would account for the considerably higher temperature and salinity which were found in the deeper layers there.

A study of these conditions from a hydrodynamical point of view shows that the water in the centre of the northern part of the Channel was actually moving slowly southwards at all depths, while there was a strong northerly flow in the eastern part of the Channel; this point will be more fully considered later.

As already stated, the salinity in the western part of the Channel was, in August, much higher in the more southerly than in the northern areas. This has been explained by the fact that the influence of the Norwegian Stream was very little felt in the more northerly part of the Channel near the Faeroes. In consequence of this, the Norwegian Sea water was able to make its way southwards into the western part of the Channel, resulting in lowering of the salinity and temperature of the water in that locality. As already explained, the plankton evidence is strongly in favour of the presence, around the Faeroes, of water from the Norwegian Sea. It is noteworthy that the temperature and salinity of the water at the stations in the western part of the Channel are usually very constant from surface to bottom.

At nearly all the stations in the Faeroe-Shetland Channel, there was, in August, a slight maximum of salinity at a point varying from 80 to 150 metres below the surface. This slight lowering of the surface salinity was probably caused by the drift southwards into the Faeroe-Shetland Channel, of water derived from the melting of ice in the Arctic regions. In this connection, we may quote from Dickson's "Hydrography of the Faeroe-Shetland Channel" already referred to—"The southward-moving currents are also of two kinds (c) water from the central and western parts of the Norwegian Sea . . . . . and (d) water derived from the melting of ice in the Arctic regions. This water is probably spread over the surface in summer and autumn and makes its way southwards to the east of Iceland and the Faeroe Islands." When considering the condition of the waters of the Channel from a hydrodynamical point of view, it will be shown that it is possible by means of them to discriminate between these two southward-moving bodies of water.

FAEROE-SHETLAND CHANNEL, NOVEMBER, 1903.

It is unfortunate that only very few observations were obtained, owing to the severity of the weather, from the Faeroe-Shetland Channel during November, 1903. The only deep station worked was 19 B (500 metres) which is situated in the southern part of the Channel (Pl. VI., 6). Surface samples were collected along the southern section as far west as 4° 16′; the position of Station 19 B was 60° 22′ N.–4° 04′ W.

In the extreme easterly part of the southern region of the Channel, the surface salinity did not exceed 35·25 per mille, while between 60° 15′ N.–3° 40′ W. and 60° 26′ N.–4° 16′ W. it was greater than 35·4 per mille. The surface salinity at Station 19 B was as high as 35·45 per mille, and at 300 metres depth it had only fallen to 35·36. Compared with the May and August observations, the salinity and temperature were remarkably high, as the following comparison shows :—

FAEROE CHANNEL, STATION 19 B, 1903.

Depth.	May. 60° 54′ N.–3° 50′ W.		August. 60° 26′ N.–4° 02′ W.		November. 60° 22′ N.–4° 04′ W.	
	Temperature °C.	S.°/₀₀	Temperature °C.	S.°/₀₀	Temperature °C.	S.°/₀₀
0 metres	9·06	35·34	10·91	35·26	9·14	35·45
200 „	6·86	35·17	7·55	35·24	9·31	35·38
300 „	6·25	35·15	6·34	35·16	9·16	35·36
400 „	4·68	35·02	5·65	35·10	8·08	35·25
500 „	1·44	34·96	4·89	35·07	7·21	35·21

Combining the few November Faeroe-Shetland Channel results with the work done by other investigators in the neighbouring regions, it would seem that the Norwegian Stream during that month followed almost the same course as in the previous August. It appears to have passed to the south of the Faeroes flowing in an almost easterly direction towards the Shetlands, and to have again assumed a northerly or north-easterly direction on approaching the eastern side of the Channel. The area of flow of the Norwegian Stream was very similar in August and November, but its waters appear to have been of considerably higher salinity during the latter month, and judging from the salinity and temperature at Station 19 B, its centre of flow then appears to have extended to a somewhat greater depth. Norwegian Sea water appears to have again made its way southwards into the central and western parts of the Channel, although probably not to so great an extent as in August. It is impossible, in the absence of further observations, to state anything definite in regard to the hydrographic conditions of the Faeroe-Shetland Channel during November 1903.

CONCLUSIONS FROM THE YEAR'S WORK.

In conclusion, a short summary of the chief results of the year's work will be given. It must, however, be clearly understood that the following remarks hold good only in connection with the hydrographic conditions existing during the year in question. It is premature to conclude that, because a certain state of conditions has been found to exist during the year 1903, the same will hold good in succeeding years, or that because there has been an apparent seasonal change during one year, the same variation will repeat itself in the next. It would be unwise until the investigations have been carried on for several years to state definitely which changes are periodical and which are not.

The greatest inflow of Atlantic water into the North Sea through the channels south of the Shetlands undoubtedly took place during the earlier part of the year. This influx in August, 1902, was small, and

the same remark applies in a lesser degree to the volume of the inflow in November of the same year. By May, 1903, it had greatly increased, although, in the absence of February observations, it is impossible to say whether or not there had been a maximum inflow during the intervening period. From May, 1903, onwards till November, the quantity of Atlantic water entering the North Sea apparently decreased steadily in volume, so far as our infrequent observations permit us to judge.

By February, 1904, it had recommenced to flow strongly and appeared at that time to flood the greater part of the north-western area of the North Sea. The surface salinity observations which have been carried out over the North Sea since May, 1903, are entirely in accordance with these results ; they show that the quantity of 35 per mille water present in the surface increased from September, 1903, to March or April, 1904, and then again began to diminish.* In this case we have evidence extending over nearly two years, all of which points to the conclusion that the inflow of Atlantic water into the North Sea through the channels south of the Shetlands takes place most largely in the early part of the year, probably about March or April.

A consideration of the results for the year tends to show that the cold salt water, present in varying quantity in the north-western area of the North Sea throughout the year, was probably Atlantic water which had entered the North Sea basin through the openings between Scotland and Shetland during the previous winter and which, remaining in that area, had become cooled down by contact with the atmosphere and with the surrounding colder water. Another explanation may be that this water had, at some period, moved southwards as an undercurrent from the central or western parts of the Norwegian Sea.

The widest distribution during 1903 of salt Atlantic water over the surface area in and around the Faeroe-Shetland Channel appears, judging from the observations available, to have been in May. Both the direction of flow and the volume of the Norwegian Stream seem to be more or less influenced by the volume and strength of the southward-flowing Polar Stream. The inflow of Atlantic water through the Faeroe-Shetland Channel appears to be subject to variations which may occur at frequent and irregular intervals, so that, especially in regard to the Norwegian Stream, it is unsafe to draw conclusions as to its future variations from the results of a single year's work.

Norwegian Sea water was apparently able to make its way southwards at all seasons of the year. In May it entered the Faeroe-Shetland Channel as an undercurrent, except in the most westerly area where it apparently moved southwards on the surface as far as the Faeroes. In August and November this southward-moving water entered the northern part of the Channel at all depths except on the eastern side where it was prevented by the opposing flow of the Norwegian Stream. The lowering of salinity in the western side of the Channel near the Faeroes was evidently due to this Norwegian Sea water ; cold Polar water is rarely, if ever, found round the Faeroes, and the effect of the coast water from these islands on the salinity of the surrounding waters appears to be very small.

Later on, we shall find that the conclusions arrived at in this way from hydrographical considerations receive much support and confirmation when the information available is dealt with from a hydrodynamical point of view.

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* As already stated, however, there are other factors, besides the inflow of Atlantic water, which must be taken into account as affecting the surface salinity of the North Sea.

PART II.—HYDRODYNAMICAL TREATMENT OF THE CONDITIONS OF THE FAEROE-SHETLAND CHANNEL DURING THE SUMMER OF 1903.

Introductory Remarks.

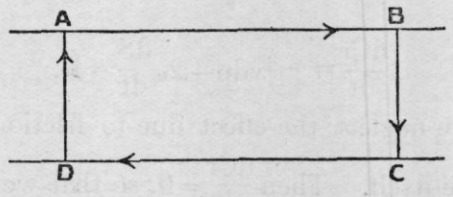
Before proceeding to the treatment—from a hydrodynamical point of view—of the conditions existing throughout the summer of 1903 in the Faeroe-Shetland Channel, a few preliminary points which call for notice will be discussed. In this region of the sea, as already stated, we have to deal with the opposing motions of waters of northern and southern origin.

The main current moving towards more northerly latitudes is the Norwegian Stream, which consists of a body of salt warm Atlantic water, which reaches the Faeroe-Shetland Channel apparently flowing in an easterly or north-easterly direction from the Faeroes towards the Shetlands. Near the eastern side of the Channel it assumes a more northerly flow and finally passes away in a north-easterly direction towards the coast of Norway.

The southward-moving currents are of two kinds, viz., water derived from the melting of ice in the Arctic regions (which gives rise to the Polar stream), and water moving southwards from the central and western parts of the Norwegian Sea* into more southerly latitudes. One branch of the Polar stream, the East Icelandic Polar current, makes its way southwards along the east coast of Iceland into the regions north of the Faeroe-Shetland Channel; its cold water very rarely penetrates, however, as far southwards as the Faeroe islands, being prevented from doing so by the opposing motion of the Atlantic stream, which causes it to bend round and to flow back in a northerly direction. The other southward-moving body of water, that from the Norwegian Sea, usually sinks below the warmer and lighter northward-moving Atlantic water and enters the Faeroe-Shetland Channel as an undercurrent. Sometimes, however, as in August, 1903, when the Norwegian Stream flows across the Channel in an easterly direction and is chiefly confined to the more southerly area, this water makes its way at all depths into the region of the sea between the Faeroes and the Shetlands, afterwards sinking under the lighter Atlantic water and entering the southern area of the Channel as an undercurrent.

In making a hydrodynamical treatment of the conditions of the sea, various objects are kept in view, these being the determination of the directions in which the various currents are flowing, the estimation of the velocity of the water at the various depths and so forth, as far as it can be done without considering the action of causes outside the area dealt with.

From the salinity and temperature of the water at the various stations the density *in situ* of the water at different depths from surface to bottom may be calculated. By means of these latter quantities, we may arrive at some interesting conclusions regarding the conditions of the waters in the regions under consideration. Consider two stations A and B, with a current flowing northwards



in a direction vertical to the section between the stations, and let the points C and D be at 100 metres

* "Norwegian Sea" water must not be confounded with "Norwegian Stream" water.

depth. In the northern hemisphere the earth's rotation causes a current to be deflected to the right in the direction in which it is flowing, and this deflection is proportional to the velocity of the current itself. If, then, the current-velocity in this case be regarded as being greatest at the surface and as decreasing with increasing depth, and the velocity at 100 metres be accordingly less than the velocity at the surface, the water-particles between the stations will be forced more to the right at the surface than at 100 metres, and a circulation will be set up round the closed curve A B C D between the stations, as shown by the direction of the arrows. This circulation, caused by the rotation of the earth, is generally checked by having lighter water along B C than at corresponding depths along A D, this new set of forces tending to set up a circulation round the curve in the opposite direction, so that the two motions neutralise each other and there is, in consequence, no screw circulation round the curve itself. Thus, if the velocity of a current decrease from the surface downwards, and if the lighter water be found on the eastern side of the current, the current is in all probability moving northwards, while, if the heavier water be present on the eastern side and the same conditions with regard to change of velocity still hold good, the movement is more probably taking place in a southerly direction. On the other hand, when the maximum velocity is not at the surface but at some depth below it, the conditions of density with regard to northward and southward motion are reversed. These statements only hold good on the assumption that there is no screw circulation round the closed curve itself. We may state the above conclusions in another way, viz., that if the lighter water be found on the eastern side of a current, then the current is flowing either in a northerly direction with a velocity greatest in the surface and decreasing with increasing depth, or southwards with a maximum velocity at some point below the surface.

Let us now consider various cases of current velocity in connection with northward and southward-flowing streams and the distribution of densities which may be expected to result from them. In the case of a southward-flowing stream where the velocity increases from the surface downwards to a maximum at a certain point and then decreases again towards the bottom the lighter water will from the surface downwards be first of all found on the eastern side, and, after the point of maximum velocity has been passed, on the western side of the current, this change of density being such as to counteract the effect of the earth's rotation on the decreasing velocity towards the bottom. If, again, the rate of motion of a southward-moving stream decrease at all depths from surface to bottom the lighter water will at every point be found along the western side of the current. If we have a southward-flowing body of water underlying a northward-flowing one, and if the lighter water in the upper (northward-moving) layer be present on the eastern side, it then follows that the velocity of the northward-flowing stream is decreasing from the surface downwards ; but at the point where the opposite-moving layers meet, the velocity will be nil, and so the velocity of the southward-flowing water will *increase* for some distance downwards beyond this point. Hence the lighter water will continue along the same side of the current even after the direction of flow has changed, and it is in consequence difficult to determine the depth at which a northward movement changes into a southern one. In cases of this kind a study of the hydrographic conditions may afford much assistance as to the direction of motion of the waters.

By means of Bjerknes' formula (*vide* Sandström and Helland-Hansen, App. , p.) we may calculate the difference between the velocity of the surface current and that at various depths. The formula in question,

$$\frac{dCr}{dt} = -\int v dp - 2\omega \frac{dS}{dt} - R,$$

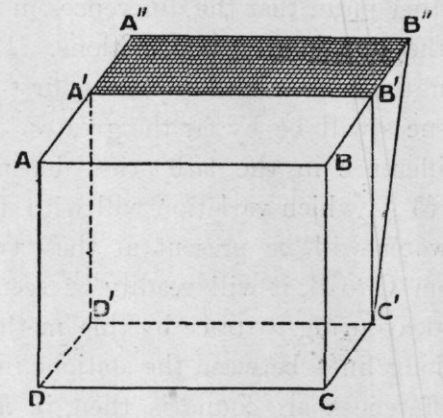
may be simplified considerably if we neglect the effect due to friction (R) and also suppose that there is no screw circulation round the curve itself. Then $\frac{dCr}{dt} = 0$, so that we now have

$$\int v dp = 2\omega \frac{dS}{dt},$$

where ω is the angular velocity of the earth, and S the projection of the closed curve on the equatorial plane.* And, further, since the currents are chiefly horizontal we may neglect the vertical component, so that the last expression becomes

$$\int v dp = 2\omega \frac{d\sigma}{dt} \sin \lambda.$$

Consider the closed water-curve A B C D, with velocity greatest in the surface (A B) and decreasing downwards. Then, after a certain time, the curve will have taken up some such position as A″ B″ C′ D′,



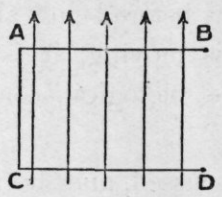
the water along A B having moved further than the water along C D. This difference is represented by B′ B″. Then $\frac{d\sigma}{dt}$, which is the change of projection of the water surface with the time, is represented by B′ B″ × A′ B′, so that we may find the value of B′ B″ (Δ) as follows :—

$$\Delta = \frac{\int v dp}{2\omega \sin \lambda \times A' B'}.$$

Take, as an example, the calculation of the velocity-difference at the surface and 600 metres between stations 13 A and 14 A in the Faeroe-Shetland Channel during August, 1903. The distance between these stations was then 48,000 metres, and the value of $2\omega \sin \lambda$ for their mean latitudes (given in Table 12 of the above-mentioned paper) was $1{\cdot}279 \times 10^{-4}$. The difference in the number of c.g.s. solenoids† at 600 metres between these stations (depending on the difference of the densities *in situ* of the water present at that depth at these two stations respectively) was then 9,100, so that we have

$$\Delta = \frac{9100}{1{\cdot}279 \times 480} = 14{\cdot}8 \frac{\text{cm}}{\text{sec}}.$$

If we now assume that the direction of current flow was at that time vertical to the line joining stations 13 A and 14 A, the result of this calculation proves that there then was a difference in the region between these stations of nearly 15 cm. per sec. in the velocities at the surface and at 600 metres depth respectively. This result would be much under the true value if, instead of flowing in a direction vertical to the section between the stations, the stream were moving slantwise across it ; and, further, if the movement were taking place *along* the line joining these points, the value shown by the calculation would be even more misleading. A moment's consideration will make this clear. Let A and B be two



stations in the northern section of the Channel, and C and D two in the southern section. Then if the current is flowing in the direction indicated by the arrows, *i.e.*, in an almost northerly direction, and if

* For explanation as to derivation, &c., of this formula, the reader is referred to Sandström and Helland-Hansen's paper, *infra*, p. 135.

† For explanation of the term "solenoids," cf. *ibid.*, p. 141.

the velocity is greatest in the surface and decreases with increasing depth, lighter water will be found along the line B D than at corresponding depths along A C, this difference of density being necessary to counteract the effect of terrestrial rotation on the varying velocity of the current ; in other words, to prevent a screw circulation being set up round the curve enclosed within the surface and bottom layers between the stations. When these differences of density are great, we infer that the velocity-differences at the surface and at various depths are also great, and the calculations actually show this to be the case ; when these differences are small, it may either mean that the differences in velocity are small or that the current is flowing, not across, but *along* the line joining the stations. If we, in the case considered above, calculate the velocity-differences from the surface to 600 metres, first between stations A and B and then between A and C, the former differences will be by far the greater. This must necessarily be the case, for the magnitude of the velocity-difference in the latter case depends on the change in density of the water found along the line from C to A, which variation will with the present motion of the current be very small, as practically similar water will be present at these two stations. In the case where the direction of flow is slantwise, as from C to B, it will readily be seen that the velocity-differences will be intermediate in value. Thus, in endeavouring to trace by this method the direction of flow of a current, it is well to make the calculations along lines between the stations in all possible directions. The section *along* which the greatest velocity-differences are found is, then, in all probability situated in a direction perpendicular to the direction of flow of the stream.

Consider now a case in which the direction of flow of a current is northwards in the surface, and let the velocity-difference, from 0 to 1,000 metres, as calculated above, be 15 $\frac{\text{cm}}{\text{sec}}$. Then, if the lighter water be present on the eastern side of the current the rate of motion will be greatest in the surface and will decrease with increasing depth. If we now assume that the water at 1,000 metres depth is stationary, we have a surface velocity of 15 $\frac{\text{cm}}{\text{sec}}$. The water at 1,000 metres depth may, however, be moving northwards with a velocity of (say) 2 $\frac{\text{cm}}{\text{sec}}$., in which case the surface velocity has been underestimated and ought to be, not 15, but 17 $\frac{\text{cm}}{\text{sec}}$. ; on the other hand, if the water at 1,000 metres were moving *southwards* at a rate of 2 $\frac{\text{cm}}{\text{sec}}$. the surface velocity would only be 13 $\frac{\text{cm}}{\text{sec}}$. If, however, the direction and strength of the surface current had actually been found by means of a current-meter, it would then become possible to deduce from these calculations much valuable information as to the direction and force of the currents at the various depths.

In some cases it is extremely difficult, in absence of direct measurement, to differentiate between a northward movement with a velocity decreasing from the surface downwards and a southward one where the velocity reaches a maximum velocity at some point below the surface. In cases of this kind, one must be guided chiefly by the temperature and salinity, as well as by the biological conditions, of the water in the region under consideration. Thus before being able to state, with any degree of certainty, the direction in which a body of water is moving, it is necessary to take into consideration the hydrodynamical, the hydrographical and the biological conditions of the water, each in conjunction with the others.

Making use of the hypotheses already discussed, and bearing in mind those facts now mentioned, let us proceed to consider, from a hydrodynamical point of view, the conditions which existed, throughout the summer of 1903, in the Faeroe-Shetland Channel.

By making use of Bjerknes' formula as described above, the following Table of velocity-differences has been compiled. These calculations have been made between the various stations in various directions,

first of all along the northern line, then along the southern line, and lastly along lines drawn between stations in the northern and the southern sections of the Channel ; and values for both May and August have been deduced. Positive values indicate, in reference to calculations made between stations along the northern *or* along the southern sections of the Channel, that the lighter water was found at the more easterly station ; negative values, for calculations made under similar conditions, indicate that the lighter water was present at the more westerly station. Where the values were calculated along lines joining stations in the northern with stations in the southern sections, positive values show that the density of the water was greater at the more northerly station, negative values that it was greater at the more southerly one.

FAEROE CHANNEL, MAY, 1903.

Velocity-difference from	Calculated between Stations along Northern Section.				
	15B–16A.	15A–15B.	14A–15A.	13A–14A.	13A–15A.
0–40 metres	0·40 cm/sec	—	—	—	—
0–60 „	0·45 „	0·38 cm/sec	0·23 cm/sec	—	—
0–100 „	0·15 „	0·63 „	0·60 „	0·56 cm/sec	0·57 cm/sec
0–200 „	—	—	1·31 „	1·75 „	—
0–300 „	—	—	1·62 „	3·42 „	2·44 cm/sec
0–400 „	—	—	2·20 „	5·40 „	—
0–500 „	—	—	3·75 „	—	—
0–600 „	—	—	5·60 „	—	—

FAEROE CHANNEL, MAY, 1903.

Velocity-difference from	Calculated between Stations along Southern Section.						
	17–18A.	18A–19A.	19A–19B.	19B–20A.	18A–20A.	20A–21A.	21A–21.
0–40 metres	—	0·49 cm/sec	—	—	—	—	−0·47 cm/sec
0–80 „	—	0·84 „	—	—	—	−0·50 cm/sec	—
0–100 „	0·8 cm/sec	1·00 „	− 1·0 cm/sec	2·90 cm/sec	0·88 cm/sec	−0·75 „	−1·07 cm/sec
0–150 „	—	1·4 „	—	—	—	—	—
0–200 „	—	1·1 „	− 1·6 cm/sec	6·00 cm/sec	—	—	—
0–300 „	—	0·7 „	− 1·5 „	9·97 „	2·90 cm/sec	—	—
0–400 „	—	—	− 1·6 „	15·60 „	3·54 „	—	—
0–500 „	—	—	− 3·2 „	25·60 „	—	—	—
0–550 „	—	—	—	—	—	—	—
0–600 „	—	—	− 4·6 cm/sec	—	—	—	—
0–700 „	—	—	− 6·1 „	—	—	—	—

FAEROE CHANNEL, AUGUST, 1903.

Velocity-difference from	Calculated along Northern line of Stations.					
	16A–16.	15B–16A.	15A–15B.	14A–15A.	13A–14A.	13A–15A.
0–40 metres	0·25 $\frac{cm}{sec}$	0·40 $\frac{cm}{sec}$	0·32 $\frac{cm}{sec}$	0·26 $\frac{cm}{sec}$	—	—
0–60 „	0·04 „	—	—	—	—	—
0–80 „	—	—	0·51 $\frac{cm}{sec}$	—	—	—
0–100 „	−1·2 $\frac{cm}{sec}$	0·02 $\frac{cm}{sec}$	0·52 „	0·35 $\frac{cm}{sec}$ (0·00 at 150 m.)	0·60 $\frac{cm}{sec}$	0·47 $\frac{cm}{sec}$
0–200 „	—	0·10 „	0·13 „	−0·33 $\frac{cm}{sec}$	1·56 „	—
0–300 „	—	—	—	−1·33 „	2·52 „	0·74 $\frac{cm}{sec}$
0–400 „	—	—	—	−2·75 „	5·70 „	—
0–500 „	—	—	—	−3·25 „	10·95 „	4·35 $\frac{cm}{sec}$
0–600 „	—	—	—	−3·45 „	14·80 „	6·22 „
0–800 „	—	—	—	−4·02 „	—	—
0–1000 „	—	—	—	−4·80 „	—	—
0–1200 „	—	—	—	−5·00 „	—	—

FAEROE CHANNEL, AUGUST, 1903.

Velocity-difference from	Calculated along Southern line of Stations.					
	17–18A.	18A–19A.	19A–19B.	18A–19B.	19B–20A.	20A–21A.
0–40 metres	2·3 $\frac{cm}{sec}$	0·05 $\frac{cm}{sec}$	0·04 $\frac{cm}{sec}$	—	−0·72 $\frac{cm}{sec}$	1·80 $\frac{cm}{sec}$
0–60 „	—	—	0·24 „	—	—	—
0–80 „	3·07 $\frac{cm}{sec}$	—	0·08 „	—	—	—
0–100 „	2·98 „	0·4 $\frac{cm}{sec}$	−0·17 „	0·15 $\frac{cm}{sec}$	−1·50 $\frac{cm}{sec}$	3·46 $\frac{cm}{sec}$
0–150 „	—	—	—	—	−0·81 „	—
0–200 „	—	2·0 $\frac{cm}{sec}$	−2·43 $\frac{cm}{sec}$	—	+1·02 „	—
0–300 „	—	3·4 „	−5·20 „	0·42 $\frac{cm}{sec}$	—	—
0–400 „	—	—	−8·27 „	—	—	—
0–500 „	—	—	−9·43 „	—	—	—
0–550 „	—	—	−9·51 „	—	—	—

FAEROE CHANNEL, MAY, 1903.

Velocity-difference from	Calculated between Stations in Northern and Southern Sections.							
	15A–18A.	14A–19A.	13A–19B.	13A–20A.	15A–19A.	14A–18A.	14A–20A.	13A–19A.
0–100 metres ...	−0·23 cm/sec	−0·01 cm/sec	−0·56 cm/sec	0·12 cm/sec	0·43 cm/sec	−0·42 cm/sec	0·49 cm/sec	−0·20 cm/sec
0–300 „ ...	−0·18 „	−0·51 „	−2·48 „	0·20 „	0·55 „	−0·84 „	1·86 „	−1·59 „
0–400 „ ...	−0·03 „	—	—	—	—	−1·00 „	—	—
0–500 „ ...	—	−1·90 cm/sec	—	—	0·46 cm/sec	—	4·40 „	—
0–600 „ ...	—	−3·05 „	—	—	0·64 „	—	—	—
0–700 „ ...	—	−3·65 „	—	—	—	—	—	—
0–1000 „ ...	—	—	—	—	—	—	—	—

FAEROE CHANNEL, AUGUST, 1903.

Velocity-difference from	Calculated between Stations in Northern and Southern Sections.							
	15B–18A.	15A–19A.	14A–19B.	13A–19B.	15B–19A.	15A–19B.	14A–19A.	14A–20A.
0–100 metres ...	0·50 cm/sec	0·4 cm/sec	0·2 cm/sec	−0·05 cm/sec	0·65 cm/sec	0·32 cm/sec	0·25 cm/sec	−0·23 cm/sec
0–200 „ ...	0·65 „	—	—	—	1·60 „	—	—	−0·85 „
0–300 „ ...	—	2·8 cm/sec	1·02 cm/sec	−0·08 cm/sec	—	0·50 cm/sec	2·96 cm/sec	—
0–500 „ ...	—	7·16 „	4·23 „	−0·51 „	—	2·93 „	4·28 „	—
0–550 „ ...	—	—	—	−0·69 „	—	—	—	—
0–600 „ ...	—	8·67 cm/sec	—	—	—	—	8·95 cm/sec	—
0-1000 „ ...	—	12·08 „	—	—	—	—	12·45 „	—

As explained above, a study of these values affords much information both as to the strength and as to the direction of flow of the various currents. In absence of actual measurement of current velocity they give only the *differences* in the rate of motion at the various depths, unless it be assumed, in the case of very deep stations, that the bottom water is nearly stationary, in which cases the difference in velocity between the surface and bottom layers gives a more or less accurate value for the rate of flow of the surface current. As previously shown, the maximum velocity-differences are obtained when the calculations are made between stations lying along lines which are vertical to the direction of flow of the current.

HYDRODYNAMICAL CONDITIONS OF THE FAEROE-SHETLAND CHANNEL, MAY, 1903.

Let us now consider from this standpoint the results which may be deduced from the values for the Faeroe-Shetland Channel during May, 1903. There was then found to be, in general, a gradual increase in the density of the water on passing from the Shetland toward the Faeroe side of the Channel, indicating, probably, that the upper layers of water in the Channel were moving towards more northerly latitudes,

although the direction of flow near the Faeroes was perhaps more nearly north-easterly than northerly. The hydrographic observations for that month show that the Atlantic flow was then, both in the northern and southern sections of the Channel, strongest near the Shetlands, where it extended to a depth of about 500 metres. The above Tables for May indicate that the greatest velocity-differences were then also found in the eastern part of the Channel and that they were, moreover, considerably greater when calculated *along* the northern and southern lines than when calculated crosswise. In other words, the Norwegian Stream was, during May, 1903, running in a northerly or north-easterly direction and was chiefly confined to the eastern part of the Channel.

It must be understood that in the above Tables the positive and negative signs only furnish information as to the direction of flow of the currents when the calculations are carried out along lines more or less vertical to the movement of the water; where the calculations are made in directions parallel to the direction of flow the values found are likely to be small and the positive or negative signs do not lead to any definite conclusions as to the direction of flow, but simply distinguish, as a matter of fact, between the stations at which denser or lighter water is present, as the case may be.

Between stations 19 B and 20 A, near the Shetland side of the southern section of the Channel, the velocity-difference from 0 to 500 metres was 25·6 $\frac{\text{cm}}{\text{sec}}$. If we now assume that the water at 500 metres was nearly stationary, we have a surface velocity of 25·6 $\frac{\text{cm}}{\text{sec}}$., or nearly 14 miles in 24 hours. As the current appeared to be flowing in a north-easterly direction, and as it is unlikely that the water at 500 metres depth was entirely stationary, this velocity of the surface water is probably somewhat under the true value. Of course, there is always the possibility that the water at 500 metres was moving *southwards*, which would mean that the surface rate of flow was so much the less. The velocity-difference in the northern part of the Channel near the Shetlands was considerably less, only about one-third of the above value. This is probably due to the broadening out of the Norwegian Stream in that region, resulting in a slower motion of its waters; it may be also that its direction of flow assumed a more easterly bent north of the Shetlands, which would diminish the values found in calculating the velocity-differences in the region between 13 A and 14 A. In the centre of the Channel the differences in velocity were considerably smaller than in the more easterly part, this being evidently due to a slower rate of flow in the surface. A glance at the hydrographic sections for that month shows that the Norwegian Stream was, during May, 1903, running much more strongly northwards on the easterly side of the Channel than in the central and western parts; it is, moreover, probable that the direction of flow of the waters in the western side of the Channel was in a north-easterly direction, and that the Norwegian Stream assumed a more northerly bent near the Shetland side of the Channel. This supposition is in accordance with results arrived at both from a hydrographical and hydrodynamical point of view. The values for the velocity-differences of the current, as calculated by Bjerknes' formula, were much greater in the region near the Shetlands than in other parts of the Channel, and the smaller values found along lines joining stations in the northern and southern sections show that the direction of flow of the Norwegian Stream was then north-easterly in the central parts of the Channel. If the Atlantic flow across the Channel from the Faeroes to the Shetlands had been in an *easterly* direction it is probable that the lighter water would have been found at the stations along the southern section. This, however, was not the case, as in almost all instances the lighter water was present at the more northerly stations. The deep parts of the Channel were in May, 1903, filled with water having approximately the same temperature and salinity as the water which exists all over the bottom of the Norwegian Sea, this water having evidently moved southwards and entered the Faeroe-Shetland Channel as an undercurrent. The values found by calculation show that the water in the deeper parts of the Channel was actually moving slowly

southwards. Between stations 19 A and 19 B there appeared to be a southward movement at nearly all depths, the velocity-difference from 0–700 metres showing a southward flow of 6·1 $\frac{\text{cm}}{\text{sec}}$., or about 3 miles in 24 hours at the surface. The great differences in the values found between neighbouring stations (19 A–19 B and 19 B–20 A) are worthy of attention, but these differences are quite in accordance with the hydrographic conditions then prevailing, as a glance at that section will at once show. The water in the western part of the Channel near the Faeroes was then also apparently moving southwards at all depths ; in the region between stations 15 B and 16 A there was a southward flow, with a maximum velocity at 60 metres depth.

We thus conclude that, in May, 1903, the Norwegian Stream flowed past the Faeroes into the Faeroe-Shetland Channel in an almost north-easterly direction, and that it assumed a more northerly flow near the Shetland side of the Channel. Norwegian Sea water then apparently made its way southwards and entered the Channel as an undercurrent, except in the most westerly region, where it appeared to move southwards at all depths. The surface velocity of the northward-moving Norwegian Stream was probably about 15 miles in 24 hours, while the southward-flowing water from the Norwegian Sea apparently moved only about 3 miles during the same interval of time.

Hydrodynamical Conditions of the Faeroe-Shetland Channel, August, 1903.

As already observed, the hydrographic conditions prevailing in the Faeroe-Shetland Channel in August, 1903, were considerably different from those found during May of the same year. In August, judging from the hydrographic observations, the Norwegian Stream passed *south* of the Faeroes, flowing in an easterly direction, and when near the centre of the Channel assumed an almost northerly flow, after which it crossed the Channel and passed away in a north-easterly direction towards the Norwegian coast. On account of the limitation of the Atlantic flow to the *southern* part of the Faeroe side of the Channel, Norwegian Sea water was enabled to make its way southwards at all depths into the more northerly regions of the Channel, after which it sank below the warmer Atlantic water and entered the southern area as an undercurrent. We shall now see that a consideration of the same problems from a hydrodynamical point of view results in complete agreement with the results arrived at above.

In the first place, we notice in making the above calculations for August that in the western and central parts of the Channel the lighter water was in all cases found at the more southerly stations, indicating that the flow across the Channel from the Faeroes towards the Shetlands was, first of all, in an easterly direction. In the eastern part of the Channel near the Shetlands these conditions no longer held good, indicating a probable change of direction of the current in that region. When the calculations were made along lines joining stations in the northern and southern sections, the largest values for the velocity-differences were found in the region between stations 15 A–19 A and 14 A–19 A ; when the values were estimated along the southern line of stations the maximum differences were found between stations 20 A–21 A in the eastern part of the Channel ; whilst in the northern section the largest values were given by the calculations made from stations 13 A–14 A, also in the eastern part of the Channel. All these results point to entire agreement with the direction of flow of the Norwegian Stream arrived at from hydrographic considerations, *i.e.*, an easterly flow in the western part of the Channel changing into an almost northerly one towards the Shetlands, so that the current at various parts of its courses actually crossed, in an almost vertical direction, the lines joining stations 14 A–19 A, 20 A–21 A, and 13 A–14 A (Chart , p. 64). That the Norwegian Stream was mainly confined to the eastern side of the Channel in the more northerly area is shown by the results of difference in current velocity calculated for the region between stations 14 A and 15 A ; these values are entirely different from those obtained between stations 13 A and 14 A,

showing that the influence of the Norwegian Stream did not extend further westwards in that region of the Channel than station 14 A. The values found along the lines joining stations 13 A–19 B and 14 A–20 A were very small in comparison with those for the other stations ; another proof that the current was flowing more or less in a direction *along* these lines and not across them. The differences in velocity from 0–1000 metres between stations 14 A–19 A and 15 A-19 A indicate, on the assumption that the bottom water was nearly stationary, a surface velocity for the Norwegian Stream of about 7 miles in 24 hours, but this value is probably underestimated. The values from the area between 13 A and 14 A show that the rate of flow was at least 8·5 miles in 24 hours, and as this calculation is made by assuming that the water at 600 metres had no motion whatsoever, the velocity of the surface current is probably at least about 10 miles per 24 hours.

The water in the centre of the Channel was apparently moving southwards at all depths. In the region between stations 14 A and 15 A there was a southward movement of the upper layers, with a maximum velocity at 100 metres ; at 150 metres the velocity was the same as at the surface, and below this point there was evidently a separate southward motion, slightly slower than that of the overlying water and decreasing gradually towards the bottom. As the water at 1,200 metres would probably be almost stationary we have a southward velocity at 150 metres depth of 3 miles in 24 hours ; the surface water was moving at the same rate, and the water at 100 metres at a slightly greater velocity—about 3·2 miles in 24 hours. A study of the hydrographic data shows that at nearly all the stations in the Channel there existed, in August, a maximum of salinity at a depth varying from 80 to 150 metres below the surface. This slight lowering of the surface salinity was probably caused by the drift southwards into the Faeroe-Shetland Channel of water derived from the melting of ice in the Arctic regions. In this connection we may quote from Dickson's " Hydrography of the Faeroe-Shetland Channel," already referred to :—" The southward-moving currents are also of two kinds—(c) water from the central and western parts of the Norwegian Sea . . . . and (d) water derived from the melting of ice in the Arctic regions. This water is probably spread over the surface in summer and autumn and makes its way southwards to the east of Iceland and the Faeroe Islands." In the manner described above, by making use of the hydrodynamical calculations, it seems possible to discriminate between these two southward-flowing bodies of water.

In the centre of the southern section of the Channel the water was apparently moving southwards at all depths except in the upper layers, where there appeared to be a northward motion. The velocity-difference in the region between stations 19 A–19 B was as great as 9·5 $\frac{\text{cm}}{\text{sec}}$. from 0–550 metres, this being much larger than the corresponding value found in the northern part of the Channel and being in all probability due to a northward movement in the surface. In the more westerly part of the Channel near the Faeroes there was a southward movement in the more northerly area with a maximum velocity at some depth (usually from 60–80 metres) below the surface ; this was again evidently Norwegian Sea water which had made its way southward into this region of the Channel.

Thus, in August, 1903, we have found, from a study both of the hydrographical and the hydrodynamical results, that the Norwegian Stream flowed into the Faeroe-Shetland Channel south of the Faeroes, crossed towards the Shetlands flowing in an easterly direction, and afterwards bent round and assumed a more northerly flow in the eastern region of the Channel. We have seen, also, that Norwegian Sea water then penetrated southwards at all depths into the northerly area of the Channel, subsequently sinking underneath the lighter Atlantic water and entering the more southerly regions as an undercurrent. It is thus evident that a study of the conditions of the sea from a hydrodynamical standpoint affords much useful and conclusive evidence, which, taken in conjunction with hydrographic and biological observations from the corresponding areas, may ultimately assist in the solution of the great problems in connection with the strength and direction of flow of oceanic currents.

TABLE 1.

Depth (Metres).	May Cruise, 1903.					August Cruise, 1903.					November Cruise, 1903.				
	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹
—	—					Lat., N. 57° 46′; Long., W. 2° 11′. 10/viii, 9h. p.m.—10h. 5m. p.m.					—				
0	—	—	—	—	—	11·52	34·75	26·510	*154*	*0*	—	—	—	—	—
10	—	—	—	—	—	11·37	34·75	26·536	*150*	*1520*	—	—	—	—	—
20	—	—	—	—	—	11·11	34·79	26·613	*143*	*2985*	—	—	—	—	—
40	—	—	—	—	—	10·97	34·79	26·639	*141*	*5825*	—	—	—	—	—
60	—	—	—	—	—	10·61	34·80	26·712	*136*	*8595*	—	—	—	—	—
80	—	—	—	—	—	10·09	34·82	26·823	*126*	*11215*	—	—	—	—	—
100	—	—	—	—	—	10·00	34·82	26·839	*125*	*13725*	—	—	—	—	—
150	—	—	—	—	—	9·85	34·86	26·884	*122*	*19900*	—	—	—	—	—
180	—	—	—	—	—	9·84	34·88	26·906	*122*	*23560*	—	—	—	—	—

Station Sc. 1.

Depth (Metres).	May Cruise, 1903.					August Cruise, 1903.					November Cruise, 1903.				
	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹
—	—					Lat., N. 58° 00′; Long. W. 2° 54′. 11/viii, 5h. a.m.—6h. a.m.					Lat., N. 58° 00′; Long. W. 2° 54′. 13/xi, 4h. p.m.—5h. 30m. p.m.				
0	—	—	—	—	—	11·50	34·80	26·551	*150*	*0*	9·95	34·76	26·789	*127*	*0*
20	—	—	—	—	—	10·69	34·84	26·727	*133*	*2830*	9·86	34·76	26·804	*125*	*2520*
30	—	—	—	—	—	10·63	34·84	26·737	*133*	*4160*	9·84	34·76	26·807	*125*	*3770*
40	—	—	—	—	—	10·60	34·86	26·752	*131*	*5480*	9·84	34·76	26·807	*125*	*5020*
60	—	—	—	—	—	10·60	34·88	26·772	*130*	*8090*	9·00	34·76	26·809	*126*	*7530*

TABLE 1—*continued.*

Depth (Metres).	May Cruise, 1903.					August Cruise, 1903.					November Cruise, 1903.				
	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹
STATION SC. 2.															
—	Lat., N. 58° 38′; Long., W. 1° 46′. 22/v, 10h. a.m.—11h. a.m.					Lat., N. 58° 36′; Long., W. 1° 46′. 11/viii, 11h. a.m.—12 noon.					Lat., N. 58° 36′; Long., W. 1° 46′. 18/xi, 4h. 10m. a.m.—5h. 5m. a.m.				
0	7·86	35·23	27·493	*60*	*0*	11·25	34·99	26·742	*132*	*0*	9·65	34·98	27·024	*105·5*	*0*
10	—	—	—	—	—	11·19	35·01	26·773	*129*	*1305*	9·10	34·97	27·105	*97·5*	*1015*
15	7·69	35·27	27·557	*54·5*	*858*	—	—	—	—	—	—	—	—	—	—
20	—	—	—	—	—	11·13	35·01	26·784	*128*	*2600*	8·90	34·97	27·138	*94·5*	*1975*
40	7·55	35·27	27·577	*52·5*	*2195*	10·28	35·21	27·090	*100*	*4880*	9·00	34·97	27·122	*97*	*3939*
60	—	—	—	—	—	9·81	35·21	27·171	*91*	*6790*	9·00	34·97	27·122	*98*	*5889*
80	7·29	35·29	27·625	*50*	*4243*	9·80	35·21	27·173	*92*	*8620*	8·89	34·98	27·149	*96*	*7829*
100	7·25	35·29	27·631	*48·5*	*5227*	9·46	35·23	27·239	*86*	*10400*	8·91	34·98	27·146	*96*	*9749*
STATION SC. 3.															
—	Lat., N. 59° 10′; Long., W. 1° 27′. 22/v, 2h. p.m.—3h. p.m.					Lat., N. 59° 10′; Long., W. 1° 27′. 11/viii, 3h. 40m. p.m.—4h. 40m. p.m.					Lat., N. 59° 10′; Long., W. 1° 27′. 18/xi, 9h. 15m. a.m.—10h. a.m.				
0	8·36	35·42	27·562	*52*	*0*	10·80	35·21	26·997	*106*	*0*	9·55	35·16	27·167	*91*	*0*
10	—	—	—	—	—	10·58	35·21	27·036	*103*	*1045*	9·65	35·12	27·121	*95*	*930*
20	7·62	35·27	27·567	*53*	*1050*	10·18	35·21	27·106	*97*	*2045*	9·65	35·12	27·121	*95*	*1880*
40	—	—	—	—	—	10·16	35·23	27·119	*96*	*3975*	9·66	35·12	27·119	*95*	*3780*
50	7·30	35·27	27·613	*50*	*2595*	—	—	—	—	—	—	—	—	—	—
60	—	—	—	—	—	10·16	35·23	27·119	*96*	*5895*	9·68	35·12	27·116	*96*	*5690*
80	7·30	35·29	27·623	*50*	*4095*	10·16	35·23	27·119	*96*	*7815*	9·66	35·12	27·119	*97*	*7620*
100	7·31	35·29	27·622	*50*	*5095*	10 11	35·25	27·139	*95*	*9725*	9·66	35·12	27·119	*97*	*9560*

TABLE 1—*continued.*

Depth (Metres).	May Cruise, 1903.					August Cruise, 1903.					November Cruise, 1903.				
	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹
STATION SC. 4.															
—	Lat., N. 59° 26′; Long., W. 1° 20′. 23/v, 10h. p.m.—11h. p.m.					Lat., N. 59° 26′; Long., W. 1° 20′. 11/viii, 6h. 15m. p.m.—7h. p.m.					Lat., N. 59° 26′; Long., W. 1° 26′. 18/xi, 12 noon—12h. 45m. p.m.				
0	8·16	35·32	27·516	*57*	*0*	10·80	35·25	27·017	*104*	*0*	9·35	35·14	27·189	*89*	*0*
10	—	—	—	—	—	10·28	35·26	27·129	*94*	*990*	9·52	35·14	27·161	*91*	*900*
15	7·76	35·32	27·576	*51*	*810*	—	—	—	—	—	—	—	—	—	—
20	—	—	—	—	—	10·26	35·28	27·142	*93*	*1925*	9·53	35·14	27·160	*91*	*1810*
40	—	—	—	—	—	10·00	35·30	27·207	*88*	*3735*	9·53	35·14	27·160	*91*	*3630*
50	7·59	35·33	27·611	*49·5*	*2567*	—	—	—	—	—	—	—	—	—	—
60	—	—	—	—	—	9·86	35·30	27·230	*86*	*5475*	9·54	35·14	27·158	*92*	*5460*
80	7·52	35·35	27·640	*48*	*4028*	9·69	35·30	27·259	*84*	*7175*	9·54	35·14	27·158	*93*	*7310*
100	7·50	35·35	27·643	*48*	*4988*	—	—	—	—	—	9·54	35·14	27·158	*93*	*9170*
STATION SC. 5.															
—	Lat., N. 59° 40′; Long., W. 1° 14′. 23/v, 7h. p.m.—8h. p.m.					Lat., N. 59° 40′; Long., W. 1° 14′. 11/viii, 8h. 20m. p.m.—9h. 50m. p.m.					Lat., N. 59° 40′; Long., W. 1° 14′. 18/xi, 3h. 5m. p.m.—3h. 40m. p.m.				
0	7·86	35·35	27·590	*51*	*0*	10·20	35·26	27·143	*93*	*0*	9·25	35·26	27·303	*78*	*0*
10	—	—	—	—	—	10·10	35·26	27·161	*92*	*925*	9·28	35·26	27·298	*78*	*780*
20	7·77	35·33	27·584	*51*	*1020*	10·02	35·28	27·185	*89*	*1830*	9·28	35·28	27·308	*78*	*1560*
40	—	—	—	—	—	10·00	35·28	27·187	*89·5*	*3614*	9·26	35·26	27·301	*78*	*3120*
60	7·64	35·35	27·623	*49*	*3020*	10·00	35·28	27·187	*89·5*	*5404*	9·26	35·26	27·301	*79*	*4690*
80	—	—	—	—	—	10·00	35·28	27·187	*90·5*	*7204*	9·27	35·26	27·299	*80*	*6280*
90	7·64	35·35	27·623	*50*	*4505*	—	—	—	—	—	9·29	35·26	27·296	*80*	*7080*
100	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

TABLE 1—*continued.*

Depth (Metres).	May Cruise, 1903.					August Cruise, 1903.					November Cruise, 1903.				
	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹
STATION SC. 6.															
—	Lat., N. 60° 37′; Long., E. 0° 30′. 26/v, 1h. a.m.—2h. a.m.					Lat., N. 60° 40′; Long., E. 0° 27′. 12/viii, 11h. 20m. a.m.—12h. 50m. p.m.					Lat., N. 60° 37′; Long., E. 0° 30′. 18/xi, 1h. 40m. p.m.—3h. p.m.				
0	8·46	35·35	27·497	*60*	*0*	12·37	35·20	26·692	*136*	*0*	9·39	35·26	27·280	*81*	*0*
10	—	—	—	—	—	12·17	35·22	26·751	*129*	*1325*	9·44	35·26	27·271	*82*	*815*
20	8·23	35·35	27·533	*56*	*1160*	11·27	35·22	26·921	*114*	*2540*	9·44	35·26	27·271	*82*	*1635*
40	7·99	35·35	27·571	*53*	*2250*	10·04	35·29	27·190	*88*	*4560*	9·44	35·26	27·271	*82*	*3275*
60	—	—	—	—	—	9·08	35·31	27·370	*72*	*6160*	9·44	35·26	27·271	*83*	*4925*
70	7·85	35·35	27·591	*53*	*3840*	—	—	—	—	—	—	—	—	—	—
80	7·84	35·35	27·593	*53*	*4370*	8·58	35·33	27·459	*65*	*7530*	—	—	—	—	—
100	7·69	35·36	27·625	*50*	*5400*	8·33	35·33	27·498	*61*	*8790*	9·45	35·26	27·271	*84*	*8265*
130	7·68	35·36	27·626	*50*	*7150*	8·07	35·33	27·539	*57*	*10560*	9·45	35·26	27·271	*84*	*10785*
STATION SC. 7.															
—	Lat., N. 61° 09′; Long., E. 2° 00′. 26/v, 8h. a.m.—9h. a.m.					Lat., N. 61° 09′; Long., E. 2° 00′. 12/viii, 6h. 5m. p.m.—7h. 20m. p.m.					Lat., N. 61° 09′; Long., E. 2° 00′. 18/xi, 8h. p.m.—9h. p.m.				
0	8·56	35·31	27·452	*64*	*0*	12·98	33·57	25·301	*267*	*0*	9·04	35·30	27·367	*72*	*0*
10	—	—	—	—	—	12·88	33·66	25·393	*258*	*2625*	9·04	35·30	27·367	*72*	*720*
20	8·29	35·31	27·485	*60*	*1240*	11·66	34·96	26·636	*141*	*4620*	9·04	35·30	27·367	*72*	*1440*
30	—	—	—	—	—	10·06	35·26	27·158	*91*	*5780*	—	—	—	—	—
40	8·19	35·33	27·520	*57*	*2410*	9·69	35·26	27·220	*86*	*6665*	9·04	35·30	27·367	*72*	*2880*
60	8·11	35·31	27·523	*58*	*3560*	8·77	35·27	27·391	*71*	*8235*	9·04	35·30	27·367	*73*	*4330*
80	8·07	35·33	27·539	*56*	*4700*	8·46	35·27	27·440	*68*	*9625*	—	—	—	—	—
100	8·00	35·35	27·570	*55*	*5810*	8·08	35·29	27·509	*59*	*10895*	9·10	35·30	27·357	*75*	*7290*
130	7·87	35·36	27·598	*52*	*7415*	—	—	—	—	—	—	—	—	—	—
140	—	—	—	—	—	7·62	35·29	27·577	*53*	*13135*	9·14	35·32	27·360	*74*	*10250*

TABLE 1—*continued.*

STATION SC. 8.

Depth (Metres).	May Cruise, 1903.					August Cruise, 1903.					November Cruise, 1903.				
	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹
—	Lat., N. 61° 32′; Long., E. 2° 50′. 26/v, 12 noon—2h. 30m. p.m.					Lat., N. 61° 32′; Long., E. 3° 10′. 12/viii, 11h. 5m. p.m.—2h. a.m.					Lat., N. 61° 32′; Long., E. 3° 10′. 19/xi, 1h. 15m. a.m.—4h. a.m.				
0	7·96	32·77	25·552	*244*	*0*	13·50	30·29	22·683	*518*	*0*	8·89	35·14	27·265	*82*	*0*
10	7·21	33·12	25·930	*207*	*2255*	13·09	30·62	23·012	*485*	*5015*	8·85	35·16	27·281	*80*	*810*
15	—	—	—	—	—	10·29	32·47	24·953	*302*	*6982*	—	—	—	—	—
20	5·83	33·62	26·511	*153*	*4055*	9·69	33·13	25·566	*240*	*8337*	8·85	35·16	27·281	*80*	*1610*
25	—	—	—	—	—	8·35	34·18	26·602	*145*	*9299*	—	—	—	—	—
30	5·27	34·06	26·921	*114*	*5390*	7·77	34·42	26·864	*119*	*9959*	—	—	—	—	—
40	5·41	34·48	27·237	*84·5*	*6382*	7·04	34·72	27·212	*87*	*10989*	9·10	35·23	27·299	*78*	*3190*
50	5·52	34·65	27·352	*72·5*	*7167*	—	—	—	—	—	—	—	—	—	—
60	5·69	34·68	27·361	*72·5*	*7892*	6·49	34·90	27·433	*67*	*12529*	9·23	35·26	27·306	*78*	*4750*
70	6·10	34·90	27·486	*62*	*8564*	6·73	34·94	27·430	*67*	*13199*	—	—	—	—	—
80	7·45	35·15	27·495	*62*	*9184*	7·00	35·03	27·463	*65*	*13859*	9·24	35·26	27·305	*79*	*6320*
100	7·80	35·29	27·552	*57*	*10374*	6·34	34·96	27·493	*62*	*15129*	9·23	35·32	27·346	*74*	*7850*
150	7·57	35·27	27·576	*55·5*	*13184*	6·85	35·14	27·570	*55*	*18054*	9·23	35·34	27·366	*74*	*9330*
200	7·36	35·24	27·576	*56*	*15969*	6·88	35·16	27·576	*54*	*20779*	8·79	35·30	27·407	*73*	*13005*
250	—	—	—	—	—	6·25	35·08	27·602	*53*	*23454*	8·15	35·30	27·503	*64*	*16430*
300	6·61	35·15	27·613	*53·5*	*21439*	6·26	35·08	27·601	*54*	*26129*	7·72	35·28	27·552	*60*	*19530*
350	—	—	—	—	—	6·31	35·10	27·614	*54*	*28829*	6·67	35·17	27·624	*53*	*22355*
390	5·25	35·07	27·718	*43*	*25777*	6·27	35·10	27·619	*54*	*30989*	—	—	—	—	—

TABLE 1—*continued.*

STATION SC. 9.

Depth (Metres).	May Cruise, 1903.					August Cruise, 1903.					November Cruise, 1903.				
	Temperature °C.	S.‰	σ_t	v—v¹	E—E¹	Temperature °C.	S.‰	σ_t	v—v¹	E—E¹	Temperature °C.	S.‰	σ_t	v—v¹	E—E¹
—	Lat., N. 61° 34′; Long., E. 2° 06′. 26/v, 4h. p.m.—5h. p.m.					Lat., N. 61° 34′; Long., E. 2° 05′. 13/viii, 4h. 50m. a.m.—6h. 10m. a.m.					Lat., N 61° 34′; Long., E. 2° 05′. 19/xi, 7h. 30m. a.m.—9h. a.m.				
0	8·66	34·99	27·184	*90*	*0*	12·29	34·36	26·054	*197*	*0*	9·04	35·28	27·348	*73*	*0*
10	—	—	—	—	—	11·96	34·71	26·398	*164*	*1805*	9·00	35·30	27·376	*71*	*720*
20	—	—	—	—	—	11·29	35·27	26·956	*112*	*3185*	8·99	35·30	27·376	*71*	*1430*
30	—	—	—	—	—	10·79	35·29	27·056	*101*	*4250*	—	—	—	—	—
40	7·95	35·20	27·460	*63·5*	*3068*	10·60	35·29	27·091	*98*	*5245*	8·99	35·28	27·356	*73*	*2870*
50	—	—	—	—	—	9·54	35·27	27·264	*83*	*6150*	—	—	—	—	—
55	—	—	—	—	—	9·52	35·27	27·267	*83*	*6565*	—	—	—	—	—
60	—	—	—	—	—	9·20	35·27	27·301	*78*	*6967*	—	—	—	—	—
80	7·94	35·24	27·491	*62·5*	*5588*	9·15	35·33	27·368	*73*	*8477*	9·00	35·28	27·355	*75*	*5830*
100	7·82	35·24	27·508	*60*	*6812*	8·83	35·29	27·391	*71*	*9917*	9·00	35·28	27·355	*75*	*7330*
150	—	—	—	—	—	8·47	35·29	27·447	*65*	*13317*	8·76	35·28	27·393	*71*	*10980*
200	7·61	35·24	27·539	*59*	*12762*	8·12	35·29	27·502	*62*	*16492*	8·46	35·32	27·470	*65*	*14380*
250	7·55	39·29	27·587	*56*	*15637*	7·80	35·27	27·541	*61*	*19567*	8·00	35·32	27·541	*59*	*17480*
300	—	—	—	—	—	7·22	35·22	27·587	*58*	*22542*	7·67	35·32	27·589	*55*	*20330*
320	—	—	—	—	—	6·90	35·18	27·603	*57*	*23692*	—	—	—	—	—
350	—	—	—	—	—	—	—	—	—	—	7·02	35·23	27·616	*53*	*23030*

TABLE 1—*continued.*

Depth (Metres).	May Cruise, 1903.					August Cruise, 1903.					November Cruise, 1903.				
	Temperature °C	S.°/₀₀	σ_t	v—v¹	E—E¹	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹	Temperature °C.	S °/₀₀	σ_t	v—v¹	E—E¹
	STATION SC. 10.														
—	Lat., N. 61° 38′; Long., E. 0° 43′. 26/v, 9h. p.m.—10h. 30m. p.m.					Lat., N. 61° 37′; Long., E. 0° 45′. 13/viii, 10h. 45m. a.m.—12h. 15m. p.m.					Lat., N. 61° 38′; Long., E. 0° 43′. 19/xi, 3h. 30m. p.m.—4h. 45m. p.m.				
0	9·06	35·36	27·412	*67·5*	*0*	12·16	35·18	26·724	*133*	*0*	9·04	35·32	27·377	*85*	*0*
10	—	—	—	—	—	11·78	35·20	26·807	*125*	*1290*	—	—	—	—	—
20	8·60	35·26	27·408	*68*	*1354*	10·96	35·31	27·049	*103*	*2430*	9·24	35·30	27·334	*75*	*1600*
30	—	—	—	—	—	10·75	35·33	27·095	*98*	*3435*	—	—	—	—	—
40	—	—	—	—	—	9·92	35·33	27·240	*84*	*4345*	9·24	35·34	27·363	*72*	*3070*
60	8·15	35·26	27·479	*63*	*3974*	9·25	35·35	27·372	*72*	*5905*	—	—	—	—	—
80	8·07	35·26	27·491	*62·5*	*5228*	9·03	35·38	27·437	*67*	*7295*	9·24	35·34	27·363	*72*	*5950*
100	8·02	35·26	27·509	*60*	*6452*	8·85	35·40	27·475	*63*	*8595*	9·20	35·34	27·370	*73*	*7400*
150	7·91	35·28	27·525	*59·5*	*9437*	8·46	35·33	27·478	*63*	*11745*	—	—	—	—	—
200	7·37	35·23	27·565	*56·5*	*12337*	8·11	35·33	27·533	*60*	*14820*	9·10	35·34	27·387	*75*	*14800*
	STATION SC. 11.														
—	Lat., N. 61° 43′; Long., W. 0° 43′. 27/v, 2h. 30m.—4h. 0m. a.m.					Lat., N. 61° 43′; Long., W. 0° 43′. 13/viii, 4h. p.m.—5h. 30m. p.m.					—				
0	9·06	35·33	27·383	*70*	*0*	11·82	35·31	26·887	*117*	*0*	—	—	—	—	—
20	8·56	35·25	27·394	*68*	*1380*	11·16	35·29	26·990	*107*	*2240*	—	—	—	—	—
30	—	—	—	—	—	10·69	35·33	27·104	*98*	*3265*	—	—	—	—	—
40	8·44	35·23	27·403	*68*	*2740*	10·27	35·33	27·178	*89*	*4200*	—	—	—	—	—
60	8·34	35·23	27·419	*68*	*4110*	9·42	35·33	27·323	*77*	*5840*	—	—	—	—	—
80	7·97	35·21	27·468	*61*	*5430*	9·30	35·35	27·363	*75*	*7360*	—	—	—	—	—
100	7·76	35·23	27·509	*58*	*6660*	9·15	35·36	27·398	*71*	*8820*	—	—	—	—	—
150	—	—	—	—	—	8·96	35·36	27·429	*69*	*12320*	—	—	—	—	—
200	7·23	35·21	27·576	*52·5*	*12480*	8·79	35·35	27·440	*68*	*15745*	—	—	—	—	—
230	—	—	—	—	—	8·71	35·33	27·439	*68*	*17785*	—	—	—	—	—
280	7·14	35·21	27·589	*51*	*17016*	—	—	—	—	—	—	—	—	—	—

TABLE 1—*continued.*

Depth (Metres).	May Cruise, 1903.					August Cruise, 1903.					November Cruise, 1903.				
	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹
						STATION SC. 12.									
—	Lat., N. 61° 02′; Long., W. 1° 10′. 27/v, 8h. 0m. a.m.—9h. 15m. a.m.					Lat., N. 61° 02′; Long., W. 1° 09′. 13/viii, 9h. 40m. p.m.—11h. 5m. p.m.					—				
0	9·06	35·38	27·432	*66*	*0*	12·07	35·27	26·809	*125*	*0*	—	—	—	—	—
10	—	—	—	—	—	11·87	35·26	26·828	*122*	*1235*	—	—	—	—	—
20	8·83	35·20	27·401	*69*	*1350*	11·47	35·26	26·903	*115*	*2420*	—	—	—	—	—
30	—	—	—	—	—	10·29	35·26	27·117	*96*	*3475*	—	—	—	—	—
40	8·63	35·30	27·431	*66*	*2700*	9·72	35·26	27·215	*86*	*4385*	—	—	—	—	—
60	8·37	35·30	27·472	*62·5*	*3984*	9·13	35·27	27·333	*76*	*6005*	—	—	—	—	—
80	8·18	35·30	27·502	*60·5*	*5204*	9·00	35·31	27·384	*72*	*7485*	—	—	—	—	—
100	—	—	—	—	—	8·70	35·31	27·431	*68*	*8885*	—	—	—	—	—
120	7·88	35·32	27·559	*55·5*	*7524*	8·70	35·31	27·431	*68*	*10245*	—	—	—	—	—
						STATION SC. 13A.									
—	Lat., N. 61° 11′; Long., W. 2° 00′. 29/v, 12 noon—3h. p.m.					Lat., N. 61° 16′; Long., W. 2° 08′. 18/viii, 2h. 30m. a.m.—5h. 30m. a.m.					—				
0	9·66	35·47	27·400	*69*	*0*	10·97	35·19	26·949	*112*	*0*	—	—	—	—	—
10	—	—	—	—	—	10·84	35·16	26·943	*112*	*1120*	—	—	—	—	—
20	—	—	—	—	—	10·84	35·16	26·943	*112*	*2240*	—	—	—	—	—
40	9·25	35·39	27·410	*69*	*2760*	9·99	35·23	27·150	*94*	*4300*	—	—	—	—	—
60	—	—	—	—	—	9·21	35·23	27·280	*81*	*6050*	—	—	—	—	—
80	—	—	—	—	—	8·63	35·23	27·374	*73*	*7590*	—	—	—	—	—
100	8·72	35·32	27·428	*68*	*6870*	8·24	35·23	27·435	*67*	*8990*	—	—	—	—	—
150	8·59	35·30	27·438	*68*	*10270*	7·73	35·21	27·503	*62*	*12215*	—	—	—	—	—
200	8·51	35·30	27·451	*68*	*13670*	7·29	35·21	27·567	*57*	*15190*	—	—	—	—	—
250	—	—	—	—	—	6·86	35·17	27·598	*55*	*17990*	—	—	—	—	—
300	8·31	35·28	27·463	*68·5*	*20490*	6·30	35·14	27·645	*51*	*20640*	—	—	—	—	—
380	7·58	35·23	27·534	*63*	*25746*	—	—	—	—	—	—	—	—	—	—
400	—	—	—	—	—	5·86	35·10	27·673	*49*	*25640*	—	—	—	—	—
500	—	—	—	—	—	5·82	35·10	27·678	*50*	*30590*	—	—	—	—	—
550	—	—	—	—	—	3·31	34·90	27·801	*35*	*32715*	—	—	—	—	—
600	—	—	—	—	—	0·24	34·90	28·036	*10*	*33840*	—	—	—	—	—
620	—	—	—	—	—	−0·27	34·88	28·042	*7*	*34010*	—	—	—	—	—

TABLE 1—*continued.*

Depth (Metres).	May Cruise, 1903.					August Cruise, 1903.					November Cruise, 1903.				
	Temperature °C.	S.‰	σ_t	v—v¹	E—E¹	Temperature °C.	S.‰	σ_t	v—v¹	E—E¹	Temperature °C.	S.‰	σ_t	v—v¹	E—E¹
	STATION SC. 14A.														
—	Lat., N. 61° 20′; Long., W. 3° 06′. 29/v, 6h. p.m.—12 midnight.					Lat., N. 61° 18; Long., W. 2° 59′. 18/viii, 8h. 25m. a.m.—1h. 20m. p.m.					—				
0	8·66	35·36	27·476	*62*	*0*	10·97	35·19	26·949	*112*	*0*	—	—	—	—	—
10	—	—	—	—	—	10·77	35·19	26·984	*106*	*1090*	—	—	—	—	—
20	8·59	35·26	27·410	*68*	*1300*	10·77	35·19	26·984	*106*	*2150*	—	—	—	—	—
40	—	—	—	—	—	10·64	35·21	27·026	*105*	*4260*	—	—	—	—	—
50	—	—	—	—	—	9·13	35·21	27·294	*80*	*5185*	—	—	—	—	—
60	8·21	35·25	27·450	*64*	*3940*	8·77	35·21	27·343	*75*	*5960*	—	—	—	—	—
80	—	—	—	—	—	8·12	35·23	27·454	*65*	*7360*	—	—	—	—	—
100	8·02	35·25	27·480	*62·5*	*6468*	7·83	35·23	27·498	*61*	*8620*	—	—	—	—	—
150	—	—	—	—	—	7·33	35·23	27·571	*55*	*11520*	—	—	—	—	—
200	7·15	35·19	27·568	*57*	*12438*	6·95	35·19	27·596	*54*	*14245*	—	—	—	—	—
250	—	—	—	—	—	6·23	35·16	27·664	*47*	*16770*	—	—	—	—	—
280	—	—	—	—	—	5·97	35·12	27·673	*48*	*18195*	—	—	—	—	—
300	6·76	35·17	27·612	*55*	*18038*	5·22	35·07	27·721	*41*	*19085*	—	—	—	—	—
320	—	—	—	—	—	4·21	34·97	27·768	*36*	*19855*	—	—	—	—	—
350	—	—	—	—	—	3·16	34·90	27·815	*32*	*20875*	—	—	—	—	—
380	—	—	—	—	—	1·96	34·87	27·691	*23*	*21700*	—	—	—	—	—
400	6·15	35·12	27·646	*51*	*23338*	1·66	34·87	27·913	*21*	*22140*	—	—	—	—	—
450	5·49	35·08	27·699	*46·5*	*25773*	—	—	—	—	—	—	—	—	—	—
500	3·55	34·90	27·777	*38·5*	*27898*	0·63	34·90	28·013	*12*	*23790*	—	—	—	—	—
550	2·21	34·87	27·862	*27*	*29533*	—	—	—	—	—	—	—	—	—	—
600	1·70	34·88	27·920	*22·5*	*30768*	—0·12	34·90	28·055	*7*	*24740*	—	—	—	—	—
650	1·01	34·88	27·970	*16·5*	*31743*	—	—	—	—	—	—	—	—	—	—
700	0·52	34·88	27·999	*12·5*	*32468*	—0·39	34·90	28·068	*5*	*25340*	—	—	—	—	—
800	0·19	34·88	28·019	*10·5*	*33618*	—0·59	34·92	28·087	*3*	*25740*	—	—	—	—	—
900	—	—	—	—	—	—0·68	34·92	28·091	*0*	*25890*	—	—	—	—	—
1000	—0·17	34·87	28·027	*8*	*35458*	—0·68	34·92	28·091	*0*	*25890*	—	—	—	—	—
1200	—0·37	34·87	28·036	*6·5*	*36898*	—0·87	34·92	28·100	*—1*	*25790*	—	—	—	—	—

TABLE 1—*continued.*

Depth (Metres).	May Cruise, 1903.					August Cruise, 1903.					November Cruise, 1903.				
	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹

STATION SC. 15A.

—	Lat., N. 61° 31′; Long., W. 4° 08′. 30/v, 4h. p.m.—7h. 30m. p.m.					Lat., N. 61° 27′; Long., W. 3° 42′. 18/viii, 4h. 15m. p.m.—8h. 30m. p.m.					—				
0	8·51	35·29	27·452	*64·5*	*0*	10·92	35·23	26·986	*108*	*0*	—	—	—	—	—
10	—	—	—	—	—	10·94	35·28	26·983	*108*	*1080*	—	—	—	—	—
20	8·46	35·26	27·430	*65·5*	*1300*	10·87	35·23	26·995	*106*	*2150*	—	—	—	—	—
40	—	—	—	—	—	10·05	35·26	27·169	*92*	*4130*	—	—	—	—	—
60	7·50	35·21	27·536	*57·5*	*3760*	8·93	35·30	27·385	*71*	*5760*	—	—	—	—	—
80	—	—	—	—	—	8·60	35·30	27·437	*67*	*7140*	—	—	—	—	—
100	7·25	35·21	27·572	*54·5*	*6000*	8·18	35·26	27·474	*63*	*8440*	—	—	—	—	—
150	—	—	—	—	—	7·63	35·23	27·527	*60*	*11515*	—	—	—	—	—
200	7·08	35·21	27·597	*54*	*11420*	7·21	35·21	27·578	*56*	*14415*	—	—	—	—	—
250	—	—	—	—	—	6·84	35·19	27·610	*54*	*17165*	—	—	—	—	—
300	6·58	35·17	27·636	*53*	*16770*	6·26	35·16	27·659	*50*	*19765*	—	—	—	—	—
320	—	—	—	—	—	5·70	35·10	27·693	*46*	*20725*	—	—	—	—	—
350	6·21	35·17	27·686	*48*	*19295*	4·60	35·01	27·754	*38*	*21985*	—	—	—	—	—
380	—	—	—	—	—	3·37	34·96	27·835	*30*	*23005*	—	—	—	—	—
400	5·38	35·08	27·713	*44·5*	*21605*	2·75	34·94	27·883	*26*	*23565*	—	—	—	—	—
420	4·84	35·05	27·747	*40·5*	*22455*	—	—	—	—	—	—	—	—	—	—
450	3·28	34·90	27·804	*35*	*23586*	1·99	34·94	27·948	*19*	*24690*	—	—	—	—	—
480	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
500	1·76	34·92	27·945	*20*	*24961*	1·09	34·94	28·017	*12*	*25465*	—	—	—	—	—
550	0·88	34·90	27·998	*14*	*25811*	—	—	—	—	—	—	—	—	—	—
600	0·27	34·90	28·034	*8*	*26361*	0·72	34·94	28·037	*9*	*26515*	—	—	—	—	—
800	−0·56	—	—	—	—	−0·28	34·92	28·073	*4*	*27815*	—	—	—	—	—
1000	—	—	—	—	—	−0·46	34·92	28·081	*1*	*28315*	—	—	—	—	—
1200	—	—	—	—	—	−0·68	34·92	28·091	*−1*	*28315*	—	—	—	—	—

TABLE 1—*continued.*

Depth (Metres).	May Cruise, 1903.					August Cruise, 1903.					November Cruise, 1903.				
	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹
STATION SC. 15B.															
—	Lat. N. 61° 40′ ; Long., W. 5° 09′. 30/viii, 11h. a.m.—12h. 30m. p.m.					Lat., N. 61° 39 ; Long., W. 4° 45′. 19/viii, 1h. 45m. a.m.—3h. 20m. a.m.					—				
0	7·96	35·20	27·479	*62·5*	*0*	10·17	35·19	27·090	*97*	*0*	—	—	—	—	—
10	—	—	—	—	—	10·14	35·19	27·095	*97*	*970*	—	—	—	—	—
20	7·60	35·20	27·512	*58*	*1204*	9·93	35·17	27·117	*96*	*1935*	—	—	—	—	—
40	7·29	35·18	37·547	*56*	*2344*	9·73	35·22	27·194	*89*	*3885*	—	—	—	—	—
60	7·12	35·18	27·572	*53·5*	*3448*	8·33	35·24	27·431	*66*	*5435*	—	—	—	—	—
80	—	—	—	—	—	8·17	35·24	27·456	*65*	*6745*	—	—	—	—	—
100	6·70	35·18	27·630	*49·5*	*5508*	8·09	35·24	27·469	*64*	*8035*	—	—	—	—	—
150	6·70	35·18	27·630	*50·5*	*8508*	7·93	35·24	27·493	*63*	*11210*	—	—	—	—	—
200	—	—	—	—	—	7·66	35·22	27·522	*61*	*14310*	—	—	—	—	—
225	—	—	—	—	—	5·83	35·08	27·658	*48*	*15672*	—	—	—	—	—
STATION SC. 16A.															
—	Lat., N. 61° 46′ ; Long., W. 5° 50′. 30/v, 3h. p.m.—4h. p.m.					Lat., N. 61° 49′ ; Long., W. 5° 36′. 19/viii, 6h. a.m.—7h. 5m. a.m.					—				
0	7·16	35·13	27·517	*57*	*0*	10·00	35·19	27·120	*96*	*0*	—	—	—	—	—
10	—	—	—	—	—	9·85	35·19	27·145	*92*	*940*	—	—	—	—	—
20	6·85	35·13	27·561	*53*	*1100*	9·74	35·19	27·163	*89*	*1845*	—	—	—	—	—
40	6·85	35·11	27·551	*54·5*	*2184*	9·50	35·19	27·203	*87*	*3605*	—	—	—	—	—
60	6·79	35·13	27·569	*52·5*	*3274*	8·80	35·21	27·337	*76*	*5235*	—	—	—	—	—
80	—	35·13	—	—	—	8·34	35·21	27·409	*70*	*6695*	—	—	—	—	—
100	6·79	35·13	27·569	*52·5*	*5434*	8·07	35·21	27·451	*65*	*8045*	—	—	—	—	—
150	—	—	—	—	—	7·64	35·21	27·516	*61*	*11195*	—	—	—	—	—
200	—	—	—	—	—	7·57	35·21	27·526	*61*	*14245*	—	—	—	—	—
250	—	—	—	—	—	7·52	35·21	27·533	*61*	*17295*	—	—	—	—	—
290	—	—	—	—	—	7·52	35·21	27·533	*62*	*19755*	—	—	—	—	—

TABLE 1—*continued.*

Depth (Metres).	May Cruise, 1903.					August Cruise, 1903.					November Cruise, 1903.				
	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹
STATION SC. 16.															
—	—					Lat., N. 62° 00′; Long., W. 6° 12′. 19/viii, 9h. 25m. a.m.—11h. 35m. a.m.					—				
0	—	—	—	—	—	9·45	35·14	27·173	*89*	*0*	—	—	—	—	—
10	—	—	—	—	—	9·26	35·14	27·205	*87*	*880*	—	—	—	—	—
20	—	—	—	—	—	9·20	35·14	27·215	*86*	*1745*	—	—	—	—	—
40	—	—	—	—	—	9·16	35·14	27·222	*87*	*3475*	—	—	—	—	—
60	—	—	—	—	—	9·14	35·14	27·225	*87*	*5215*	—	—	—	—	—
80	—	—	—	—	—	9·07	35·14	27·237	*87*	*6955*	—	—	—	—	—
100	—	—	—	—	—	9·02	35·14	27·245	*87*	*8695*	—	—	—	—	—
STATION SC. 17.															
—	Lat., N. 61° 13′; Long., W. 6° 34′. 30/v, 9h. p.m.—10h. p.m.					Lat., N. 61° 12′; Long., W. 6° 33′. 20/viii, 10h. 25m. a.m.—11h. a.m.					—				
0	6·86	35·18	27·609	*49*	*0*	9·92	35·26	27·191	*89*	*0*	—	—	—	—	—
10	—	—	—	—	—	9·76	35 28	27·227	*85*	*870*	—	—	—	—	—
20	6·74	35·15	27·594	*50·5*	*994*	9·73	35·28	27·232	*85*	*1720*	—	—	—	—	—
40	—	—	—	—	—	8·89	35·28	27·371	*72*	*2505*	—	—	—	—	—
50	6·75	35·15	27·593	*51·5*	*2524*	—	—	—	—	—	—	—	—	—	—
60	—	—	—	—	—	8·77	35·28	7·390	*70*	*3925*	—	—	—	—	—
80	6·75	35·15	27·593	*52·5*	*4084*	8·76	35·28	27·392	*71*	*5335*	—	—	—	—	—
100	6·75	35·15	27·593	*52·5*	*5134*	8·75	35·28	27·393	*71*	*6755*	—	—	—	—	—
130	6·75	33·15	27·593	*53*	*6715*	8·74	35·28	27·395	*71*	*8530*	—	—	—	—	—

TABLE 1—*continued.*

Depth (Metres).	May Cruise, 1903.					August Cruise, 1903.					November Cruise, 1903.				
	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E
	STATION SC. 18A.														
—	Lat., N. 60° 56′ ; Long., W. 5° 26′. 31/v, 1h. a.m.—3h. a.m.					Lat., N. 60° 57′ ; Long., W. 5° 47′. 20/viii, 2h. 30m. p.m.—4h. 30m. p.m.					—				
0	8·26	35·27	27·470	*62*	*0*	10·92	35·28	27·025	*104*	*0*	—	—	—	—	—
10	—	—	—	—	—	10·63	35·26	27·067	*100*	*1020*	—	—	—	—	—
20	—	—	—	—	—	10·58	35·25	27·066	*99*	*2015*	—	—	—	—	—
40	7·83	35·26	27·527	*58·5*	*2408*	10·39	35·25	27·099	*99*	*3995*	—	—	—	—	—
50	—	—	—	—	—	10·02	35·25	27·155	*92*	*4950*	—	—	—	—	—
60	—	—	—	—	—	9·29	35·26	27·297	*80*	*5810*	—	—	—	—	—
80	7·27	35·22	27·579	*54*	*4656*	8·65	35·26	27·400	*71*	*7320*	—	—	—	—	—
100	7·20	35·22	27·589	*53·5*	*5730*	8·35	35·26	27·447	*66*	*8690*	—	—	—	—	—
150	7·07	35·18	27·579	*55*	*8440*	7·90	35·23	27·487	*64*	*11940*	—	—	—	—	—
200	6·95	35·17	27·586	*56*	*11215*	7·56	35·23	27·536	*60*	*15040*	—	—	—	—	—
250	—	—	—	—	—	7·44	35·21	27·543	*60*	*18040*	—	—	—	—	—
300	6·42	35·15	27·638	*51*	*16565*	7·09	35·17	27·565	*60*	*21040*	—	—	—	—	—
330	—	—	—	—	—	6·40	35·16	27·641	*51*	*22705*	—	—	—	—	—
360	—	—	—	—	—	6·40	35·16	27·641	*51*	*24235*	—	—	—	—	—
400	6·17	35·15	27·672	*49*	*21565*	—	—	—	—	—	—	—	—	—	—

TABLE 1—*continued.*

STATION SC. 19A.

Depth (Metres).	May Cruise, 1903.					August Cruise, 1903.					November Cruise, 1903.				
	Temperature °C.	S.‰	σ_t	v—v¹	E—E¹	Temperature °C.	S.‰	σ_t	v—v¹	E—E¹	Temperature °C.	S.‰	σ_t	v—v¹	E—E¹
—	Lat., N. 60° 41′; Long., W. 4° 31′. 31/v, 6h. a.m.—10h. a.m.					Lat., N. 60° 40′; Long., W. 4° 50′. 20/viii, 7h. 5m. p.m.—10h. 50m. p.m.					—				
0	8·96	35·28	27·361	*72*	*0*	11·72	35·36	26·943	*112*	*0*	—	—	—	—	—
10	—	—	—	—	—	11·72	35·36	26·943	*112*	*1120*	—	—	—	—	—
20	8·59	35·24	27·390	*70*	*1420*	11·43	35·36	26·998	*107*	*2215*	—	—	—	—	—
30	—	—	—	—	—	9·99	35·31	27·217	*86*	*3180*	—	—	—	—	—
40	8·21	35·24	27·450	*65*	*2770*	9·94	35·31	27·225	*86*	*4040*	—	—	—	—	—
60	—	—	—	—	—	9·82	35·31	27·245	*84*	*5740*	—	—	—	—	—
80	7·66	35·20	27·504	*61*	*5290*	9·63	35·31	27·278	*82*	*7400*	—	—	—	—	—
100	7·47	35·20	27·531	*58·5*	*6484*	9·44	35·33	27·321	*78*	*9000*	—	—	—	—	—
150	7·26	35·18	27·551	*58·5*	*9409*	9·39	35·36	27·358	*76*	*12850*	—	—	—	—	—
200	6·99	35·17	27·580	*56·5*	*12284*	9·09	35·35	27·398	*73*	*16575*	—	—	—	—	—
250	6·26	35·15	27·660	*48*	*15625*	8·77	35·33	27·430	*70*	*20150*	—	—	—	—	—
300	5·92	35·09	27·656	*50*	*17389*	8·60	35·33	27·457	*69*	*23625*	—	—	—	—	—
350	5·51	35·06	27·676	*47*	*19814*	8·41	35·31	27·477	*67*	*27025*	—	—	—	—	—
400	4·82	35·01	27·730	*43*	*22064*	7·47	35·22	27·550	*62*	*30250*	—	—	—	—	—
450	3·81	34·97	27·811	*35*	*24014*	5·82	35·12	27·688	*48*	*33000*	—	—	—	—	—
500	2·06	34·90	27·912	*23·5*	*25474*	5·36	35·07	27·704	*46*	*35350*	—	—	—	—	—
550	1·14	34·90	27·981	*15*	*26434*	3·78	35·07	27·883	*28*	*37200*	—	—	—	—	—
600	0·41	34·90	28·026	*11*	*27084*	3·24	35·07	27·936	*23*	*38475*	—	—	—	—	—
700	−0·14	34·92	28·066	*5·5*	*27904*	—	—	—	—	—	—	—	—	—	—
800	—	—	—	—	—	2·05	35·05	28·022	*14*	*42175*	—	—	—	—	—
900	−0·48	34·92	28·082	*2·5*	*28704*	—	—	—	—	—	—	—	—	—	—
1000	—	—	—	—	—	1·71	35·03	28·031	*14*	*44975*	—	—	—	—	—

TABLE 1—*continued.*

Depth (Metres).	May Cruise, 1903.					August Cruise, 1903.					November Cruise, 1903.				
	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹
STATION SC. 19B.															
—	Lat., N. 60° 45′; Long., W. 3° 50′. 31/v, 5h. p.m.—7h. p.m.					Lat., N. 60° 26′; Long., W. 4° 02′. 21/viii, 1h. 15m. a.m.—3h. 15m. a.m.					Lat., N. 60° 22′; Long., W. 4° 04′. 30/xi, 6h. 45m. a.m.—8h. 10m. a.m.				
0	9·06	35·34	27·394	*69*	*0*	10·91	35·26	27·007	*105*	*0*	9·14	35·45	27·467	*63*	*0*
10	—	—	—	—	—	10·94	35·26	27·002	*105*	*1050*	—	—	—	—	—
20	8·18	35·27	27·503	*62*	*1310*	10·64	35·26	27·055	*100*	*2075*	9·26	35·40	27·408	*68*	*1310*
40	—	—	—	—	—	10·49	35·26	27·081	*99*	*4065*	—	—	—	—	—
50	—	—	—	—	—	10·03	35·26	27·163	*91*	*5015*	—	—	—	—	—
60	7·89	35·27	27·528	*58·5*	*3718*	9·52	35·27	27·268	*83*	*5885*	9·26	35·38	27·398	*69*	*4050*
80	—	—	—	—	—	8·89	35·27	27·372	*74*	*7455*	—	—	—	—	—
100	7·58	35·26	27·563	*56*	*6006*	8·58	35·26	27·401	*70*	*8895*	9·30	35·38	27·391	*72*	*6870*
150	—	—	—	—	—	7·83	35·26	27·517	*60*	*12145*	9·30	35·38	27·391	*73*	*10495*
200	6·86	35·17	27·598	*54*	*11506*	7·55	35·24	27·548	*58*	*15095*	9·31	35·38	27·390	*75*	*14195*
250	—	—	—	—	—	7·16	35·22	27·595	*54*	*17895*	—	—	—	—	—
275	—	—	—	—	—	6·81	35·20	27·625	*52*	*19220*	—	—	—	—	—
300	6·25	35·15	27·661	*49*	*16656*	6·34	35·16	27·649	*49*	*20482*	9·16	35·36	27·396	*76*	*21745*
350	5·81	35·11	27·689	*46·5*	*19041*	5·80	35·10	27·680	*47*	*22882*	—	—	—	—	—
370	5·71	35·10	27·692	*46·5*	*19971*	—	—	—	—	—	—	—	—	—	—
400	4·68	35·62	27·755	*40·5*	*21276*	5·65	35·10	27·698	*46*	*25207*	8·08	35·25	27·470	*69*	*28995*
420	4·10	34·99	27·791	*36*	*22040*	—	—	—	—	—	—	—	—	—	—
450	2·78	34·96	27·914	*25·5*	*22961*	—	—	—	—	—	—	—	—	—	—
470	2·14	34·96	27·945	*19·5*	*23411*	—	—	—	—	—	—	—	—	—	—
500	1·44	34·96	27·999	*13·5*	*23906*	4·89	35·07	27·761	*42*	*29607*	7·21	35·21	27·579	*61*	*35495*
550	0·99	34·96	28·031	*10*	*24491*	4·42	35·03	27·784	*38*	*31407*	—	—	—	—	—
600	0·16	34·96	28·081	*3·5*	*24826*	—	—	—	—	—	—	—	—	—	—
700	−0·54	34·96	28·115	*0*	*24996*	—	—	—	—	—	—	—	—	—	—

TABLE 1—*continued.*

Depth (Metres).	May Cruise, 1903.					August Cruise, 1903.					November Cruise, 1903.				
	Temperature °C.	S °/₀₀	σ_t	v—v¹	E—E¹	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹
						STATION SC. 20A.									
—	Lat., N. 60° 38′; Long., W. 3° 33′. 31/v, 2h. p.m.—3h. p.m.					Lat., N. 60° 17′; Long., W. 3° 36′. 21/viii, 6h. 5m. a.m.—7h. 5m. a.m.					—				
0	9·66	35·38	27·332	*75·5*	*0*	11·25	35·42	27·079	*99*	*0*	—	—	—	—	—
20	9·33	35·35	27·358	*73*	*1484*	11·02	35·42	27·122	*95*	*1940*	—	—	—	—	—
40	—	—	—	—	—	10·53	35·40	27·190	*88*	*3770*	—	—	—	—	—
50	—	—	—	—	—	9·88	35·38	27·285	*79*	*4605*	—	—	—	—	—
60	8·91	35·33	27·407	*68·5*	*4312*	9·47	35·38	27·354	*75*	*5375*	—	—	—	—	—
80	—	—	—	—	—	9·25	35·38	27·391	*72*	*6845*	—	—	—	—	—
100	8·70	35·31	27·430	*68*	*7040*	9·25	35·38	27·391	*72*	*8285*	—	—	—	—	—
150	—	—	—	—	—	9·15	35·36	27·398	*72*	*11885*	—	—	—	—	—
200	8·30	35·31	27·493	*64*	*13640*	9·15	35·36	27·398	*73*	*15510*	—	—	—	—	—
300	8·22	35·27	27·476	*67·5*	*20210*	—	—	—	—	—	—	—	—	—	—
400	7·70	35·24	27·527	*65*	*26830*	—	—	—	—	—	—	—	—	—	—
450	7·33	35·22	27·571	*61*	*29980*	—	—	—	—	—	—	—	—	—	—
500	6·95	35·18	27·596	*60·5*	*33015*	—	—	—	—	—	—	—	—	—	—
						STATION SC. 21A.									
—	Lat., N. 60° 14′; Long., W. 2° 22′. 1/vi, 1h. a.m.—2h. a.m.					Lat., N. 60° 02′; Long., W. 3° 13′. 21/viii, 9h. 45m. a.m.—10h. 55m. a.m.					Lat., N. 60° 04′; Long., W. 3° 14′. 30/xi, 1h. 45m. a.m.—2h. 50m. a.m.				
0	9·26	35·33	27·350	*73*	*0*	11·55	35·31	26·937	*112*	*0*	9·54	35·21	27·216	*87*	*0*
20	8·49	35·26	27·425	*67*	*1400*	11·57	35·31	26·934	*112*	*2240*	9·46	35·21	27·229	*85*	*1720*
40	8·08	35·26	27·489	*62*	*2690*	11·41	35·33	26·974	*110*	*4460*	—	—	—	—	—
60	7·95	35·26	27·509	*60*	*3910*	10·71	35·35	27·120	*96*	*6520*	—	—	—	—	—
70	—	—	—	—	—	9·45	35·36	27·348	*75*	*7375*	—	—	—	—	—
80	7·90	35·26	27·516	*60*	*5110*	9·34	35·36	27·366	*74*	*8120*	9·46	35·23	27·239	*85*	*6820*
100	7·90	35·26	27·516	*60*	*6310*	9·34	35·36	27·366	*74*	*9600*	—	—	—	—	—
150	—	—	—	—	—	9·34	35·36	27·366	*74*	*13300*	9·48	35·28	27·275	*84*	*12735*

TABLE 1—*continued.*

Depth (Metres).	May Cruise, 1903.					August Cruise, 1903.					November Cruise, 1903.				
	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹
	STATION SC. 21.														
—	Lat., N. 59° 46′ ; Long., W. 2° 11′. 1/vi, 5h. a.m.—6h. a.m.					Lat., N. 59° 46′ ; Long., 2° 21′. 21/viii, 3h. p.m.—4h. p.m.					Lat., N. 59° 46′ ; Long., W. 2° 21′. 29/xi, 9h. 35m. p.m.—10h. 45m. p.m				
0	8·71	35·22	27·361	*72·5*	*0*	11·57	35·05	26·721	*132*	*0*	8·54	35·21	27·378	*71*	*0*
10	—	—	—	—	—	11·25	35·05	26·781	*127*	*1295*	—	—	—	—	—
20	7·89	35·29	27·537	*56*	*1284*	11·14	35·05	26·802	*125*	*2555*	8·99	35·10	27·220	*86*	*1570*
40	7·66	35·31	27·590	*52*	*2364*	10·69	35·07	26·902	*117*	*4975*	8·99	35·10	27·220	*86*	*3290*
60	—	—	—	—	—	10·27	35·10	27·005	*107*	*7215*	—	—	—	—	—
70	7·65	35·31	27·592	*52*	*3924*	—	—	—	—	—	—	—	—	—	—
80	—	—	—	—	—	10·18	35·15	27·060	*103*	*9315*	8·99	35·10	27·220	*87*	*6750*
90	—	—	—	—	—	10·17	35·15	27·062	*103*	*10345*	—	—	—	—	—
100	7·65	35·31	27·592	*53*	*5499*	—	—	—	—	—	—	—	—	—	—
110	7·65	35·31	27·592	*53*	*6029*	—	—	—	—	—	—	—	—	—	—
	STATION SC. 22.														
—	Lat., 59° 36′ ; Long., W. 0° 41′. 2/vi, 1h. p.m.—2h. p.m.					—					—				
0	9·16	35·34	27·376	*70·5*	*0*	—	—	—	—	—	—	—	—	—	—
10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20	8·95	35·31	27·392	*70*	*1404*	—	—	—	—	—	—	—	—	—	—
40	7·34	35·31	27·637	*55*	*2654*	—	—	—	—	—	—	—	—	—	—
60	6·88	35·31	27·703	*41*	*3614*	—	—	—	—	—	—	—	—	—	—
80	6·88	35·31	27·703	*42*	*4444*	—	—	—	—	—	—	—	—	—	—
100	6·88	35·31	27·703	*42*	*5284*	—	—	—	—	—	—	—	—	—	—
120	6·87	35·30	27·697	*43*	*6134*	—	—	—	—	—	—	—	—	—	—

TABLE 1—*continued.*

Depth (Metres).	May Cruise, 1903.					August Cruise, 1903.					November Cruise, 1903.				
	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹
STATION SC. 23.															
—	Lat., N. 59° 31′; Long., E. 0° 37′. 2/vi, 6h. p.m.—7h. p.m.					Lat., N. 59° 31′; Long., E. 0° 37′. 14/viii, 8h. 30m. a.m.—9h. 45m. a.m.					Lat., N. 59° 31′; Long., E. 0° 37′. 23/xi, 12h. 45m. a.m.—1h. 45m. a.m.				
0	9·26	35·07	27·143	*92·5*	*0*	12·40	34·66	26·264	*176*	*0*	7·85	35·14	27·427	*67*	*0*
10	—	—	—	—	—	12·46	34·68	26·271	*175*	*1755*	8·13	35·14	27·385	*70*	*685*
20	—	—	—	—	—	12·27	34·73	26·347	*168*	*3470*	8·12	35·14	27·387	*70*	*1385*
30	7·70	35·29	27·565	*53*	*2181*	—	—	—	—	—	—	—	—	—	—
40	—	—	—	—	—	10·33	35·19	27·062	*118*	*6330*	8·12	35·14	27·387	*70*	*2785*
50	—	—	—	—	—	6·92	35·26	27·660	*45*	*7145*	—	—	—	—	—
60	7·46	35·29	27·600	*51*	*3741*	6·80	35·26	27·675	*44*	*7590*	8·12	35·17	27·416	*67*	*4155*
80	7·02	35·29	27·664	*45·5*	*4705*	6.77	35·26	27·679	*45*	*8480*	7·10	35·28	27·644	*45*	*5275*
100	7·00	35·27	37·657	*47*	*5629*	6·79	35·26	27·677	*45*	*9380*	6·86	35·28	27·678	*44*	*6165*
135	—	—	—	—	—	6·79	35·26	27·677	*45*	*10505*	—	—	—	—	—
STATION SC. 24.															
—	—					Lat., N. 58° 55′; Long., E. 0° 04′. 14/viii, 2h. p.m.—3h. 30m. p.m.					Lat., N. 58° 55′; Long., E. 0° 04′. 23/xi, 7h. a.m.—8h. a.m.				
0	—	—	—	—	—	12·60	34·94	26·445	*158*	*0*	8·05	35·03	27·309	*77*	*0*
10	—	—	—	—	—	12·57	34·94	26·451	*158*	*1580*	8·30	35·08	27·309	*77*	*770*
20	—	—	—	—	—	12·29	34·94	26·506	*154*	*3140*	8·30	35·08	27·309	*77*	*1540*
40	—	—	—	—	—	9·73	35·19	27·165	*92*	*5600*	8·20	35·10	27·345	*74*	*3050*
60	—	—	—	—	—	7·23	35·23	27·585	*52*	*7040*	8·20	35·10	27·345	*75*	*4540*
80	—	—	—	—	—	6·89	35·23	27·635	*49*	*8050*	6·80	35·19	27·636	*50*	*5790*
100	—	—	—	—	—	6·89	35·23	27·635	*49*	*9030*	6·79	35·21	27·637	*47*	*6760*
120	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
140	—	—	—	—	—	—	—	—	—	—	6·80	35·21	27·636	*48*	*8660*

TABLE 1—*continued.*

Depth (Metres).	May Cruise, 1903.					August Cruise, 1903.					November Cruise, 1903.				
	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹	Temperature °C.	S.°/₀₀	σ_t	v—v¹	E—E¹
STATION Sc. 25.															
—	—					Lat., N. 58° 11′; Long., W. 0° 32′. 17/viii, 7h. 45m. p.m.—8h. 40m. p.m.					Lat., N. 58° 11′; Long., W. 0° 32′. 23/xi, 2h. 50m. p.m.—4h. p.m.				
0	—	—	—	—	—	12·25	35·17	26·697	*135*	*0*	8·65	35·21	27·361	*72*	*0*
10	—	—	—	—	—	—	—	—	—	—	8·68	35·21	27·356	*72*	*720*
20	—	—	—	—	—	12·13	35·17	26·721	*133*	*2680*	8·69	35·21	27·355	*72*	*1440*
40	—	—	—	—	—	10·09	35·23	27·133	*95*	*4960*	8·70	35·21	27·353	*72*	*2880*
60	—	—	—	—	—	8·73	35·25	27·368	*72*	*6730*	8·68	35·21	27·356	*73*	*4330*
80	—	—	—	—	—	8·33	35·25	27·431	*67*	*8120*	8·68	35·21	27·356	*74*	*5800*
100	—	—	—	—	—	8·31	35·25	27·434	*67*	*9460*	8·71	35·23	27·361	*74*	*7280*
110	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
STATION Sc. 26.															
—	—					Lat., N. 58° 09′; Long., W. 1° 50′. 17/viii, 3h. p.m.—3h. 40m. p.m.					Lat., N. 58° 09′; Long., W. 1° 50′. 18/xi, 12h. a.m.—1h. a.m.				
0	—	—	—	—	—	11·80	34·90	26·572	*148*	*0*	9·45	34·96	27·038	*104*	*0*
10	—	—	—	—	—	11·70	34·90	26·591	*146*	*1470*	9·80	34·96	26·980	*109*	*1065*
20	—	—	—	—	—	10·53	35·03	26·901	*133*	*2865*	9·84	34·96	26·973	*109*	*2160*
40	—	—	—	—	—	9·93	35·08	27·045	*103*	*5225*	9·83	34·96	26·974	*109*	*4340*
60	—	—	—	—	—	9·90	35·08	27·045	*103*	*7285*	9·82	34·96	26·976	*110*	*6530*
100	—	—	—	—	—	—	—	—	—	—	9·83	34·96	26·974	*111*	*10950*
STATION Sc. 27.															
—	—					Lat., N. 57° 30′; Long., W. 1° 19′. 18/viii, 3h. 45m. a.m.—5h. a.m.					—				
0	—	—	—	—	—	11·80	34·83	26·513	*153*	*0*	—	—	—	—	—
20	—	—	—	—	—	11·53	34·87	26·594	*145*	*3020*	—	—	—	—	—
40	—	—	—	—	—	10·25	34·94	26·883	*119*	*5660*	—	—	—	—	—
60	—	—	—	—	—	10·11	34·96	26·916	*115*	*8000*	—	—	—	—	—
80	—	—	—	—	—	9·74	35·03	27·038	*105*	*10100*	—	—	—	—	—

TABLE 1A.

(CONTAINING TEMPERATURES, &C., FOR SPECIAL STATIONS, WORKED BY *Goldseeker* IN MAY, 1903).

Depth (Metres).	Temperature °C.	S.‰	σ_t
STATION SC. "G." 1. Lat., N. 56° 02′; Long., E. 0° 31′. 28/v, 1903.			
0	9·30	34·86	26·974
10	9·32	34·86	26·972
20	7·93	34·86	27·191
40	6·32	34·95	27·486
60	6·31	34·95	27·487
80	6·31	34·93	27·477
STATION SC. "G." 2. Lat., N. 56° 35′; Long., E. 0° 59′. 28/v, 1903.			
0	9·25	34·84	26·983
10	8·08	34·89	27·204
20	7·55	34·89	27·276
40	6·57	34·89	27·413
60	6·06	34·91	27·501
80	6·07	34·91	27·500
STATION SC. "G." 3. Lat., N. 57° 26′; Long., E. 1° 41′. 27/v, 1903.			
0	9·50	34·97	27·039
10	8·34	34·99	27·235
20	7·70	34·99	27·332
40	7·11	34·97	27·409
60	6·16	35·03	27·575
80	6·16	35·07	27·605
STATION SC. "G." 4. Lat., N. 58° 06′; Long., E. 2° 14′. 27/v, 1903.			
0	9·75	34·92	26·948
10	9·46	34·92	26·997
20	7·69	34·94	27·295
40	6·25	34·99	27·535
60	6·23	34·99	27·537
STATION SC. "G." 5. Lat., N. 58° 38′; Long., E. 2° 40′. 27/v, 1903.			
0	9·30	34·96	27·052
20	7·78	34·96	27·291
40	6·70	34·97	27·464
60	6·30	35·01	27·547
80	6·29	35·01	27·548
STATION SC. "G." 6. Lat., N. 59° 25′; Long., E. 1° 48′. 26/v, 1903.			
0	9·30	34·62	26·801
10	8·66	34·75	27·00
20	8·16	34·79	27·107
40	7·02	35·23	27·615
60	6·78	35·23	27·647
80	6·79	35·27	27·686
100	6·80	35·27	27·685
120	6·81	35·27	27·684
STATION SC. "G." 7. Lat., N. 58° 52′; Long., E. 1° 22′. 26/v, 1903.			
0	9·25	35·08	27·157
10	8·60	35·08	27·262
20	7·55	35·10	27·441
40	7·43	35·08	27·439
60	6·58	35·08	27·558
80	6·50	35·10	27·589
100	6·49	35·10	27·590
115	6·49	35·10	27·590
STATION SC. "G." 8. Lat., N. 58° 13′; Long., E. 0° 49′. 26/v, 1903.			
0	8·80	34·99	27·163
10	8·64	34·99	27·188
20	7·94	34·99	27·297
40	6·76	35·13	27·573
60	6·59	35·17	27·634
80	6·47	35·15	27·631
100	6·44	35·17	27·656
120	6·44	35·15	27·636
140	6·43	35·17	27·658

TABLE 1A—*continued.*

Depth (Metres).	Temperature °C.	S.°/₀₀	σ_t	Depth (Metres).	Temperature °C.	S.°/₀₀	σ_t
STATION SC. "G." 9. Lat., N. 57° 50′; Long., E. 0° 30′. 26/v, 1903.				STATION SC. "G." 10. Lat., N. 56° 46′; Long., W. 0° 24′. 25/v, 1903.			
0	8·50	35·08	27·278	0	8·50	—	—
10	8·57	35·10	27·287	10	8·35	34·75	27·047
20	7·85	35·12	27·405	20	7·40	34·82	27·257
40	7·20	35·15	27·531	40	6·91	34·82	27·318
60	6·78	35·18	27·593	60	6·90	34·84	27·329
80	6·77	35·17	27·595	73	7·09	34·86	27·313
100	6·77	35·20	27·615				
117	6·80	35·22	27·646				

Table 2 gives a list of the surface temperatures and salinities of the water between the stations.

TABLE 2.

SURFACE OBSERVATIONS.

C.—May Cruise, 1903.

Station.	Time.		Locality.		Air.	Water.	
	Date.	Hour.	Latitude.	Longitude.	Temperature °C.	Temperature °C.	S.°/₀₀
			° ′	° ′			
Sc. 2	22/v	10 a.m.	N. 58 38	W. 1 46	11·1	7·86	35·23
	„	12 „	N. 58 49	W. 1 43	—	7·96	35·21
	„	1 p.m.	—	—	—	7·96	35·34
Sc. 3	„	2 „	N. 59 10	W. 1 27	11·1	8·36	35·42
	„	3 „	—	—	—	8·36	35·38
	„	4 „	N. 59 19	W. 1 20	—	8·26	35·32
	„	5 „	—	—	—	7·86	35·28
	„	6 „	N. 59 27	W. 1 26	—	7·66	35·26
	„	7 „	—	—	—	7·76	35·28
	„	8 „	N. 59 47	W. 1 16	—	7·76	35·28
	„	9 „	N. 59 58	W. 1 12	—	7·76	35·32

TABLE 2—*continued.*

Station	Time.		Locality.		Air.	Water.	
	Date.	Hour.	Latitude.	Longitude.	Temperature °C.	Temperature °C.	S.‰
			° ′	° ′			
	23/v	5 p.m.	—	—	—	8·36	35·57
	„	6 „	—	—	—	8·06	35·41
Sc. 5	„	7 „	N. 59 40	W. 1 14	10·0	7·86	35·35
	„	8 „	—	—	—	7·86	35·37
	„	9 „	N. 59 35	W. 1 17	—	8·16	35·30
Sc. 4	„	10 „	—	—	9·5	8·16	35·32
	„	11 „	N. 59 26	W. 1 20	—	8·06	35·35
	25/v	9 „	—	—	—	8·16	35·46
	„	10 „	—	—	—	8·36	35·44
	,	11 „	—	—	—	8·36	35·44
	„	12 „	—	—	—	8·36	35·41
Sc. 6	26/v	1 a.m.	N. 60 37	E. 0 30	9·5	8·46	35·35
	„	2 „	N. 60 37	E. 0 30	—	8·56	35·37
	„	3 „	—	—	—	8·46	35·28
	„	4 „	—	—	—	8·36	35·28
	„	5 „	—	—	—	8·36	35·34
	„	6 „	—	—	—	8·46	35·32
	„	7 „	—	—	—	8·46	35·29
Sc. 7	„	8 „	N. 61 09	E. 2 00	10·0	8·56	35·31
	„	9 „	—	—	—	8·66	35·29
	„	10 „	—	—	—	7·86	33·66
	„	11 „	—	—	—	7·76	33·13
Sc. 8	„	12 „	N. 61 32	E. 2 50	9·5	7·96	32·77
	„	2 p.m.	—	—	—	8·56	32·84
	„	3 „	—	—	—	8·56	34·29
Sc. 9	„	4 „	N. 61 34	E. 2 05	10·6	8·66	34·99
	„	5 „	—	—	—	8·56	35·03
	„	6 „	—	—	—	9·76	35·29
	„	7 „	—	—	—	9·26	35·29
	„	8 „	—	—	—	9·26	35·26

TABLE 2—*continued.*

Station.	Time.		Locality.		Air.	Water.	
	Date.	Hour.	Latitude.	Longitude.	Temperature °C.	Temperature °C.	S.‰
			° ′	° ′			
Sc. 10	26/v	9 p.m.	N. 61 38	E. 0 43	10·0	9·06	35·36
	„	10 „	—	—	—	9·06	35·33
	„	11 „	—	—	—	8·96	35·29
	„	12 „	—	—	—	8·96	35·31
	27/v	1 a.m.	—	—	—	8·96	35·35
Sc. 11	„	2 „	N. 61 43	W. 0 43	9·5	9·06	35·33
	„	3 „	—	—	—	8·96	35·33
	„	4 „	—	—	—	8·96	35·33
	„	5 „	—	—	—	9·06	35·35
	„	6 „	—	—	—	8·86	35·36
	„	7 „	—	—	—	8·96	35·42
Sc. 12	„	8 „	N. 61 02	W. 1 10	11·1	9·06	35·38
	„	9 „	—	—	—	9·81	35·44
	„	10 „	—	—	—	9·81	35·42
	„	12 „	N. 60 46	W. 1 09	—	—	—
	29/v	9 „	N. 60 38	W. 1 18	—	9·46	35·53
	„	10 „	—	—	—	9·66	35·62
	„	11 „	—	—	—	9·61	35·40
	„	12 „	—	—	—	9·66	35·44
Sc. 13A	„	1 p.m.	N. 61 11	W. 2 00	10·5	9·66	35·47
	„	2 „	—	—	—	9·66	35·40
	„	3 „	—	—	—	9·56	35·33
	„	4 „	—	—	—	9·16	35·29
	„	5 „	—	—	—	8·66	35·35
Sc. 14A	„	6 „	N. 61 20	W. 3 06	9·0	8·66	35·36
	30/v	1 a.m.	—	—	—	8·46	35·38
	„	2 „	—	—	—	8·66	35·36
	„	3 „	—	—	—	8·46	35·27
Sc. 15A	„	4 „	N. 61 31	W. 4 08	7·9	8·51	35·29
	„	8 „	—	—	—	8·36	35·29

TABLE 2—*continued.*

Station.	Time.		Locality.		Air.	Water.	
	Date.	Hour.	Latitude.	Longitude.	Temperature °C.	Temperature °C.	S.‰
			° ′	° ′			
	30/v	9 a.m.	—	—	—	7·96	35·26
	„	10 „	—	—	—	8·06	35·26
Sc 15B	„	11 „	N. 61 40	W. 5 09	7·9	7·96	35·22
	„	12 „	—	—	—	7·86	35·18
	„	1 p.m.	—	—	—	8·06	35·20
	„	2 „	—	—	—	8·06	35·17
Sc. 16A	„	3 „	N. 61 46	W. 5 50	—	7·16	35·13
	„	4 „	—	—	—	7·06	35·13
	„	5 „	N. 61 50	W. 6 17	—	6·96	35·15
	„	6 „	—	—	—	7·06	35·18
	„	7 „	—	—	—	7·26	35·20
	„	8 „	—	—	—	7·06	35·22
Sc. 17	„	9 „	N. 61 15	W. 6 34	7·9	6·86	35·18
	„	10 „	—	—	—	7·16	35·20
	„	11 „	—	—	—	7·76	35·18
	„	12 „	—	—	—	8·36	35·29
Sc. 18A	31/v	1 a.m.	N. 60 56	W. 5 26	9·5	8·26	35·27
	„	4 „	—	—	—	8·16	35·26
	„	5 „	—	—	—	8·56	35·29
Sc. 19A	„	6 „	N. 60 41	W. 4 31	9·5	8·96	35·28
	„	11 „	—	—	—	9·01	35·27
	„	12 „	N. 60 31	W. 3 53	—	9·81	35·38
	„	1 p.m.	—	—	—	9·76	35·42
Sc. 20A	„	2 „	N. 60 38	W. 3 33	11·1	9·66	35·38
	„	4 „	—	—	—	9·46	35·35
Sc. 19B	„	5 „	N. 60 45	W. 3 50	10·6	9·06	35·34
	„	8 „	—	—	—	9·26	35·31
	„	9 „	—	—	—	9·26	35·29
	„	10 „	—	—	—	9·46	35·40
	„	11 „	—	—	—	9·26	35·33
	,	12 „	—	—	—	9·36	35·29

TABLE 2—*continued.*

Station.	Time.		Locality.		Air	Water.	
	Date.	Hour.	Latitude.	Longitude.	Temperature °C.	Temperature °C.	S.‰
			° ′	° ′			
Sc. 21A	1/vi	1 a.m.	N. 60 14	W. 2 22	10·0	9·26	35·33
	,,	3 ,,	—	—	—	9·36	35·27
	,,	4 ,,	—	—	—	9·06	35·20
Sc. 21	,,	5 ,,	N. 59 46	W. 2 11	9·5	8·71	35·22
	,,	7 ,,	—	—	—	8·46	35·27
	,,	8 ,,	N. 59 51	W. 1 17	—	9·06	35·27
	2/vi	11 ,,	—	—	—	9·41	35·55
	,,	12 ,,	N. 59 42	W. 0 45	—	9·06	35·48
Sc. 22	,,	1 p.m.	N. 59 36	W. 0 41	9·5	9·16	35·34
	,,	3 ,,	—	—	—	8·86	35·20
	,,	4 ,,	—	—	—	9·06	35·22
	,,	5 ,,	—	—	—	9·31	35·18
Sc. 23	,,	6 ,,	N. 59 31	E. 0 37	7·9	9·26	35·07
	,,	8 ,,	—	—	—	8·96	35·24
	,,	9 ,,	—	—	—	8·66	35·25
	,,	10 ,,	—	—	—	8·36	35·18
	,,	11 ,,	—	—	—	8·46	35·20
	,,	12 ,,	—	—	—	8·46	35·20
	3/vi	1 a.m.	—	—	—	8·86	35·10
	,,	2 ,,	—	—	—	9·06	35·10
	,,	3 ,,	—	—	—	8·96	35·01
	,,	7 ,,	N. 57 10	W. 2 04	—	7·81	34·36

D.—August Cruise, 1903.

Sc. 0	10/viii	9 p.m.	N. 57 46	W. 2 11	12·2	11·52	34·75
Sc. 1	11/viii	5 a.m.	N. 58 00	W. 2 54	11·1	11·50	34·80
	,,	7 ,,	12 miles N.E. by E. ½ E. from Sc. 1		11·7	11·30	34·79
	,,	8 ,,	23¼ ,, ,, ,,		11·3	11·00	34·85
	,,	9 ,,	30¼ ,, ,, ,,		12·8	11·25	34·90
	,,	10 ,,	40½ ,, ,, ,,		13·5	11·30	35·03

TABLE 2—*continued.*

Station.	Time.		Locality.		Air.	Water.	
	Date.	Hour.	Latitude.	Longitude.	Temperature °C.	Temperature °C.	S.‰
			° ′	° ′			
Sc. 2	11/viii	11 a.m.	N. 58 36	W. 1 46	14·7	11·25	34·99
	„	1 p.m.	10 miles N.E. by N. ¼ N. from Sc. 2		—	11·30	35·05
	„	2 „	20¾ „ „ „		—	11·10	35·22
	„	3 „	30 „ „ „		—	11·60	35·20
Sc. 3	„	4 „	N. 59 10	W. 1 27	—	10·80	35·21
	„	5 „	9¾ miles N.E. by N. from Sc. 3		17·2	10·80	35·22
Sc. 4	„	6 „	N. 59 26	W. 1 20	14·1	10·80	35·25
	„	8 „	7½ miles N.E. by N. from Sc. 4		12·2	10·40	35·26
Sc. 5	„	8.30 „	N. 59 40	W. 1 14	11·3	10·20	35·26
	12/viii	5 a.m.	N. 59 47	W. 1 01	—	12·07	35·48
	„	6 „	N. 59 58	W. 0 50	—	11·82	35·27
	„	7 „	N. 60 06	W. 0 36	—	11·57	35·36
	„	8 „	N. 60 13	W. 0 22	—	11·67	35·35
	„	9 „	N. 60 21	W. 0 07	—	11·72	35·33
	„	10 „	N. 60 29	E. 0 07	—	12·02	35·27
	„	11 „	N. 60 36	E. 0 21	—	12·27	35·26
Sc. 6	„	12 „	N. 60 40	E. 0 27	12·7	12·37	35·20
	„	2 p.m.	N. 60 41	E. 0 28	—	12·47	—
	„	3 „	N. 60 47	E. 0 47	12·4	12·47	35·20
	„	4 „	N. 60 53	E. 1 07	12·3	12·57	35·13
	„	5 „	N. 61 00	E. 1 29	12·4	12·97	34·08
	„	6 „	N. 61 08	E. 1 51	—	12·27	34·08
Sc. 7	„	8 „	N. 61 09	E. 2 00	12·7	12·98	33·57
	„	9 „	N. 61 13	E. 2 12	12·5	12·77	33·51
	„	10 „	N. 61 18	E. 2 31	12·4	12·54	34·33
	„	11 „	N. 61 24	E. 2 49	12·7	12·67	32·95
Sc. 8	„	12 „	N. 61 32	E. 3 10	12·3	13·50	30·29
	13/viii	3 a.m.	N. 61 32	E. 2 49	11·8	12·27	34·16
	„	4 „	N. 61 33	E. 2 27	12·3	12·57	33·77
Sc. 9	„	5 „	N. 61 34	E. 2 05	12·4	12·29	34·36

TABLE 2—*continued.*

Station.	Time.		Locality.		Air.	Water.	
	Date.	Hour.	Latitude.	Longitude.	Temperature °C.	Temperature °C.	S.‰
			° ′	° ′			
	13/viii	8 a.m.	N. 61 35	E. 1 50	14·2	12·32	34·49
	„	9 „	N. 61 35	E. 1 26	14·2	12·77	34·68
	„	10 „	N. 61 36	E. 1 03	14·6	12·92	34·62
Sc. 10	„	11 „	N. 61 37	E. 0 45	12·5	12·16	35·18
	„	—	—	—	13·4	—	—
	„	1 p.m.	N. 61 37	E. 0 22	13·3	12·40	35·33
	„	2 „	N. 61 39	E. 0 00	13·2	12·40	35·18
	„	3 „	N. 61 41	W. 0 22	—	11·95	35·36
Sc. 11	„	4 „	N. 61 43	W. 0 43	13·2	11·82	35·31
	„	6 „	N. 61 39	W. 0 46	13·6	12·27	35·38
	„	7 „	N. 61 29	W. 0 52	13·3	12·17	35·36
	„	8 „	N. 61 18	W. 0 58	12·9	12·17	35·36
	„	9 „	N. 61 09	W. 1 05	—	12·17	35·36
Sc. 12	„	10 „	N. 61 02	W. 1 09	13·4	12·07	35·27
	17/viii	8 „	N. 61 02	W. 1 25	11·2	10·77	35·42
	„	9 „	N. 61 05	W. 1 33	11·2	10·87	35·44
	„	10 „	N. 61 03	W. 1 41	10·8	11·17	35·36
	„	11 „	N. 61 10	W. 1 50	10·9	11·17	35·27
	„	12 „	N. 61 13	W. 1 58	10·2	10·77	35·26
Sc. 13A	18/viii	2 a.m.	N. 61 16	W. 2 08	10·6	10·97	35·19
	„	6 „	N. 61 14	W. 2 15	10·3	10·97	35·24
	„	7 „	N. 61 15	W. 2 32	11·1	10·97	35·33
	„	8 „	N. 61 16	W. 2 49	10·9	10·97	35·27
Sc. 14A	„	9 „	N. 61 18	W. 2 59	11·6	10·97	35·19
	„	2 p.m.	N. 61 16	W. 3 08	11·3	11·72	35·46
	„	3 „	N. 61 20	W. 3 22	11·4	11·72	35·35
	„	4 „	N. 61 25	W. 3 37	13·7	11·72	35·46
Sc. 15A	„	4.30 „	N. 61 27	W. 3 42	12·4	10·92	35·23
	„	9 „	N. 61 27	W. 3 49	12·0	11·57	35·33
	„	10 „	N. 61 33	W. 4 15	12·2	11·57	35·31

TABLE 2—*continued.*

Station.	Time.		Locality.		Air.	Water.	
	Date.	Hour.	Latitude.	Longitude.	Temperature °C.	Temperature °C.	S.‰
			° ′	° ′			
	18/viii	11 p.m.	N. 61 36	W. 4 29	11·8	11·37	35·17
	„	12 „	N. 61 37	W. 4 34	11·8	9·97	35·09
Sc. 15B	19/viii	2 a.m.	N. 61 39	W. 4 45	10·1	10·17	35·19
	„	4 „	N. 61 42	W. 4 58	10·4	10·17	35·17
	„	5 „	N. 61 44	W. 5 11	9·9	10·57	35·18
Sc. 16A	„	6 „	N. 61 49	W. 5 36	10·0	10·00	35·19
	„	8 „	N. 61 50	W. 5 40	11·2	10·52	35·22
	„	9 „	N. 61 57	W. 6 05	10·6	10·52	35·24
Sc. 16	„	10 „	N. 62 00	W. 6 12	11·4	9·45	35·14
	„	2 p.m.	N. 61 49	W. 6 20	11·1	9·87	35·24
	„	3 „	N. 61 42	W. 6 07	12·4	10·17	35·22
	„	4 „	N. 61 35	W. 5 54	11·6	10·37	35·22
	„	5 „	N. 61 27	W. 5 41½	12·4	10·77	35·26
	„	6 „	N. 61 23	W. 5 35	11·5	10·77	35·27
	„	6.30 „	N. 61 20	W. 5 29	11·4	—	—
	„	7 „	N. 61 17	W 5 24	10·6	10·77	35·29
	„	8 „	N. 61 12	W. 5 17	10·8	10·57	35·27
	„	10 „	N. 61 16	W. 4 59	10·8	10·57	35·26
	„	11 „	N. 61 20	W 4 44	10·6	10·57	35·18
	„	12 „	N. 61 24	W. 4 26	10·6	10·47	35·20
Sc. 17	20/viii	11 a.m.	N. 61 12	W. 6 33	9·6	9·92	35·26
	„	12 „	N. 61 09	W. 6 27	11·0	10·37	35·28
	„	1 p.m.	N. 61 04	W. 6 10	12·0	10·47	35·32
	„	2 „	N. 60 59	W. 5 53	10·9	10·77	35·36
Sc. 18A	„	3 „	N. 60 57	W. 5 47	10·4	10·92	35·28
	„	5 „	N. 60 55	W. 5 40	10·6	11·37	35·40
	„	6 „	N. 60 48	W. 5 22	10·2	11·17	35·32
	„	7 „	N. 60 41	W. 4 58	10·2	11·47	35·38
Sc. 19A	„	7.30 „	N. 60 40	W. 4 50	10·4	11·72	35·36
	„	12 „	N. 60 33	W. 4 27	8·4	11·37	35·45

TABLE 2—*continued.*

Station.	Time.		Locality.		Air.	Water.	
	Date.	Hour.	Latitude.	Longitude.	Temperature °C.	Temperature °C.	S.‰
			° ′	° ′			
	21/viii	1 a.m.	N. 60 27	W. 4 10	—	11·17	35·30
Sc. 19B	„	2 „	N. 60 26	W. 4 02	10·0	10·91	35·26
	„	4 „	N. 60 24	W. 3 56	10·0	10·57	35·30
	„	5 „	N. 60 18	W. 3 38	10·0	11·17	35·41
Sc. 20A	„	6 „	N. 60 17	W. 3 36	11·0	11·25	35·42
	„	8 „	N. 60 15	W. 3 31	9·9	11·37	35·40
	„	9 „	N. 60 10	W. 3 16	10·9	11·37	35·40
Sc. 21A	„	10 „	N. 60 02	W. 3 13	10·3	11·55	35·31
	„	12 „	N. 59 57	W. 3 00	—	11·77	35·17
	„	1 p.m.	N. 59 52	W. 2 44	—	11·77	35·10
	„	2 „	N. 59 48	W. 2 27	11·4	11·57	35·03
Sc. 21	„	3 „	N. 59 46	W. 2 21	11·6	11·57	35·05
	„	4 „	—	—	—	11·77	35·05
Sc. 22	14/viii	4 a.m.	N. 59 36	W. 0 41	11·1	12·00	35·26
	„	5 „	8½ miles E.S.E. of Sc. 22		11·7	12·20	35·22
	„	6 „	16 „ „		12·3	12·20	34·99
	„	7 „	25½ „ „		12·6	12·30	34·73
	„	8 „	36 „ „		13·0	12·25	34·64
Sc. 23	„	9 „	N. 59 31	E. 0 37	13·2	12·40	34·66
	„	11 „	10½ miles S.W. ¼ S. of Sc. 23		11·7	12·50	—
	„	12 „	19¾ „ „		13·5	12·60	—
	„	1 p.m.	30 „ „		11·1	12·60	34·80
	„	2 „	37½ „ „		—	12·60	34·85
Sc. 24	„	2.30 „	N. 58 55	E. 0 04	14·5	12·60	34·94
	„	4 „	10 miles S.W. ½ S. of Sc. 24		—	12·50	35·08
Sc. 26	17/viii	3 „	N. 58 09	E. 1 50	—	11·80	34·90
	„	5 „	9 miles E. by S. ¼ S. of Sc. 26		—	11·90	35·03
	„	6 „	19½ „ „		—	12·00	35·08
Sc. 25	„	8 „	N. 58 11	W. 0 32	12·2	12·25	35·17
Sc. 27	18/viii	4 a.m.	N. 57 30	W. 1 19	11·7	11·80	34·83

TABLE 2—*continued.*

E.—November Cruise.

Station.	Time.		Locality.		Air.	Water.	
	Date.	Hour.	Latitude.	Longitude.	Temperature °C.	Temperature °C.	S.‰
			° ′	° ′			
Sc. 1	13/xi	4 p.m.	N. 58 00	W. 2 54	11·4	9·95	34·76
	„	6.30 „	9 miles E. ¼ S. of Sc. 1		12·0	9·95	34·76
Sc. 26	18/xi	12 „	N. 58 09	W. 1 50	7·4	9·45	34·96
	„	2 a.m.	9 miles N.N.E. of Sc. 26		8·2	9·70	34·95
	„	3 „	18 „ „		8·1	9·75	34·96
Sc. 2	„	4 „	N. 58 36	W. 1 46	7·5	9·65	34·98
	„	6 „	9 miles N.E. by N. of Sc. 2		7·0	9·75	34·97
	„	7 „	19 „ „		7·5	9·75	34·93
	„	8 „	27 „ „		7·3	9·85	34·95
Sc. 3 . ..	„	9 „	N. 59 10	W. 1 27	7·6	9·55	35·16
	„	11 „	8 miles N.E. by N. ¼ N. of Sc. 3		9·5	9·65	35·10
Sc. 4	„	12 „	N. 59 26	W. 1 20	9·4	9·35	35·14
	„	1.30 p.m.	8 miles N.E. by N. ¼ N. of Sc. 4		8·9	9·35	35·20
Sc. 5	„	3 „	N. 59 40	W. 1 14	9·2	9·25	35·26
	„	11 a.m.	N. 60 20	W. 0 22	--	9·44	35·35
	„	Noon	N. 60 26	W. 0 02	7·9	9·39	—
	„	1 p.m.	N. 60 32	E. 0 14	—	9·29	35·41
Sc. 6	„	2 „	N. 60 37	E. 0 30	—	9·39	35·26
		3 „	N. 60 37	E. 0 30	—	9·34	35·26
	„	4 „	N. 60 43	E. 0 48	8·9	9·34	35·39
	„	5 „	N. 60 49	E. 1 05	—	9·34	35·25
	„	6 „	N. 60 56	E. 1 22	—	9·34	35·21
	„	7 „	N. 61 02	E. 1 41	10·0	9·04	35·19
Sc. 7	„	8 „	N. 61 09	E. 2 00	—	9·04	35·30
		9 „	N. 61 09	E. 2 00	—	9·09	35·30
	„	10 „	N. 61 12	E. 2 09	—	9·24	35·30
	„	11 „	N. 61 18	E. 2 28	—	9·24	35·32
	„	12 „	N. 61 25	E. 2 48	9·4	9·04	35·07
	„	1 a.m.	N. 61 31	E. 3 08	—	9·04	35·12

TABLE 2—*continued.*

Station.	Time.		Locality.		Air.	Water.	
	Date.	Hour.	Latitude.	Longitude.	Temperature °C.	Temperature °C.	S.‰
			° ′	° ′			
		2 a.m.	N. 61 32	E. 3 10	10·0	8·89	35·14
Sc. 8	19/xi	3 „	N. 61 32	E. 3 10	—	—	—
		4 „	N. 61 32	E. 3 10	—	—	—
	„	5 „	N. 61 33	E. 2 52	—	9·04	35·30
	„	6 „	N. 61 34	E. 2 32	—	9·04	35·30
	„	7 „	N. 61 34	E. 2 12	—	9·04	35·30
		8 „	N. 61 34	E. 2 05	—	9·04	35·28
Sc. 9	„	9 „	N. 61 34	E. 2 05	10·0	—	—
	„	10 „	N. 61 35	E. 1 59	—	9·06	35·43
	„	11 „	N. 61 36	E. 1 44	—	9·04	35·30
	„	12 „	N. 61 36	E. 1 30	9·4	9·14	35·30
	„	1 p.m.	N. 61 37	E. 1 17	—	9·14	35·21
	„	2 „	N. 61 37	E. 1 04	—	9·14	35·28
	„	3 „	N. 61 38	E. 0 52	—	9·04	35·35
Sc 10	„	4 „	N. 61 38	E. 0 43	5·6	9·04	35·32
	„	5 „	N. 61 39	E. 0 37	—	9·04	35·32
	„	6 „	N. 61 39	E. 0 25	—	9·04	35·32
	„	7 „	N. 61 40	E. 0 15	—	9·04	35·34
	„	8 „	N. 61 41	E. 0 05	7·9	9·14	35·41
	„	9 „	N. 61 42	W. 0 04	—	9·14	35·39
	„	10 „	N. 61 39	W. 0 09	—	9·04	35·43
	„	11 „	N. 61 35	W. 0 13	—	9·04	35·37
	„	12 „	N. 61 30	W. 0 18	6·1	9·04	35·32
Sc. 21	29/xi	10 „	N. 59 46	W. 2 21	1·7	8·54	35·21
	„	11 „	N. 59 49	W. 2 28	—	—	—
	„	12 „	N. 59 54	W. 2 45	—	9·04	35·21
	30/xi	1 a.m.	N. 59 59	W. 3 00	—	8·94	35·26
		2 „	N. 60 04	W. 3 13	3·9	9·54	35·21
Sc. 21A	„	3 „	N. 60 04	W. 3 15	—	8·94	35·19
	„	4 „	N. 60 10	W. 3 30	—	9·00	35·21

TABLE 2—*continued.*

Station.	Time.		Locality.		Air.	Water.	
	Date.	Hour.	Latitude.	Longitude.	Temperature °C.	Temperature °C.	S.‰
			° ′	° ′			
	30/xi	5 a.m.	N. 60 15	W. 3 48	—	9·04	35·48
	„	6 „	N. 60 21	W. 4 03	—	—	—
Sc. 19B	„	7 „	N. 60 22	W. 4 04	3·9	9·14	35·45
		8 „	N. 60 22	W. 4 04	—	9·14	35·43
	„	9 „	N. 60 26	W. 4 16	—	9·14	35·41
	„	11 „	N. 60 25	W. 4 00	4·5	8·84	35·46
	„	12 „	—	—	—	8·84	35·37
Sc. 22	22/xi	8 p.m.	N. 59 36	W. 0 41	5·3	8·65	35·23
	„	9 „	9 miles S.E. by E. ¾ E. of Sc. 22		7·5	8·65	35·23
	„	10 „	18 „ „ „		9·5	8·35	35·25
	„	11½ „	28 „ „ „		9·2	8·25	35·21
Sc. 23	23/xi	1 a.m.	N. 59 31	E. 0 37	8·3	7·85	35·14
Sc. 24	„	7 „	N. 58 55	E. 0 04	9·0	8·05	35·03
	„	9 „	9 miles S.W. of Sc. 24		9·8	8·05	35·16
	„	10½ „	18 „ „		9·0	8·05	35·16
	„	12 „	27 „ „		9·0	8·25	35·17
	„	1 p.m.	36 „ „		9·0	8·55	35·23
	„	2 „	45 „ „		9·9	8·85	35·25
Sc. 25	„	3 „	N. 58 11	W. 0 32	10·0	8·65	35·21

Table 3 contains some soundings taken by Lieut.-Comm. Sharp, in the Faeroe-Shetland Channel during the August quarterly cruise. It will be seen that they add considerably to our knowledge of the contours, especially between 4° and 6° west, showing a much greater extension westwards of the comparatively shallow bank to the east of the Faeroes than is indicated on the Admirality Charts.

TABLE 3.

Soundings in Faeroe–Shetland Channel.

August, 1903.

Station.	Date.	Latitude.	Longitude.	Depth (Metres).	Nature of Bottom.
		° ′	° ′		
Sc. 12	13/viii	N. 61 02	W. 1 09	123	
Sc. 13A	18/viii	N. 61 16	W. 2 08	646	
Sc. 14A	„	N. 61 18	W. 2 59	1,208	
Sc. 15A	„	N. 61 27	W. 3 42	1,222	
	„	N. 61 33	W. 4 15	589	Mud.
	„	N. 61 36	W. 4 29	353	Mud and fine sand.
	„	N. 61 37	W. 4 34	222	Mud and fine sand.
Sc. 15B	19/viii	N. 61 39	W. 4 45	229	Fine sand.
	„	N. 61 44	W. 5 11	195	Fine sand.
Sc. 16A	„	N. 61 49	W. 5 36	300	
Sc. 16	„	N. 62 00	W. 6 12	104	
	„	N. 61 35	W. 5 54	165	Fine sand.
	„	N. 61 27	W. 5 41½	211	Fine sand.
	„	N. 61 20	W. 5 29	201	Sand and shells.
	„	N. 61 12	W. 5 17	362	Fine sand and shells.
	„	N. 61 16	W. 4 59	485	Fine sand.
	„	N. 61 20	W. 4 44	80[illegible]	Fine sand.
	„	N. 61 24	W. 4 26	1,080	Mud.
Sc. 17	20/viii	N. 61 12	W. 6 33	128	
Sc. 18A	„	N. 60 57	W. 5 47	366	
Sc. 19A	„	N. 60 40	W. 4 50	1,004	
Sc. 19B	21/viii	N. 60 26	W. 4 02	549	
Sc. 20A	„	N. 60 17	W. 3 36	217	
Sc. 21A	„	N. 60 02	W. 3 13	150	

N.B.—The positions for the above soundings are all to be relied on, as the weather was clear during the whole time. They were confirmed when within sight of land.

PLATES IV.—VI.

Illustrating Mr. A. J. Robertson's Report on the Hydrography of the Faeroe Channel and Northern Part of the North Sea in 1903.

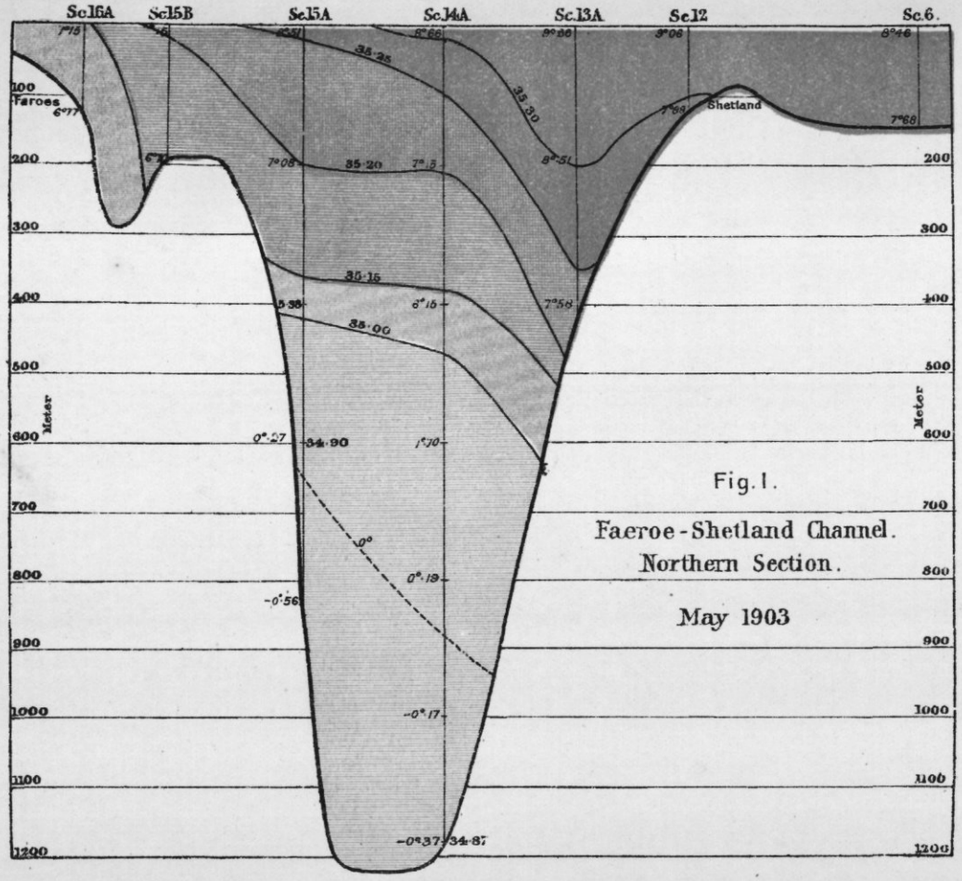


Fig. 1.

Faeroe-Shetland Channel.
Northern Section.

May 1903

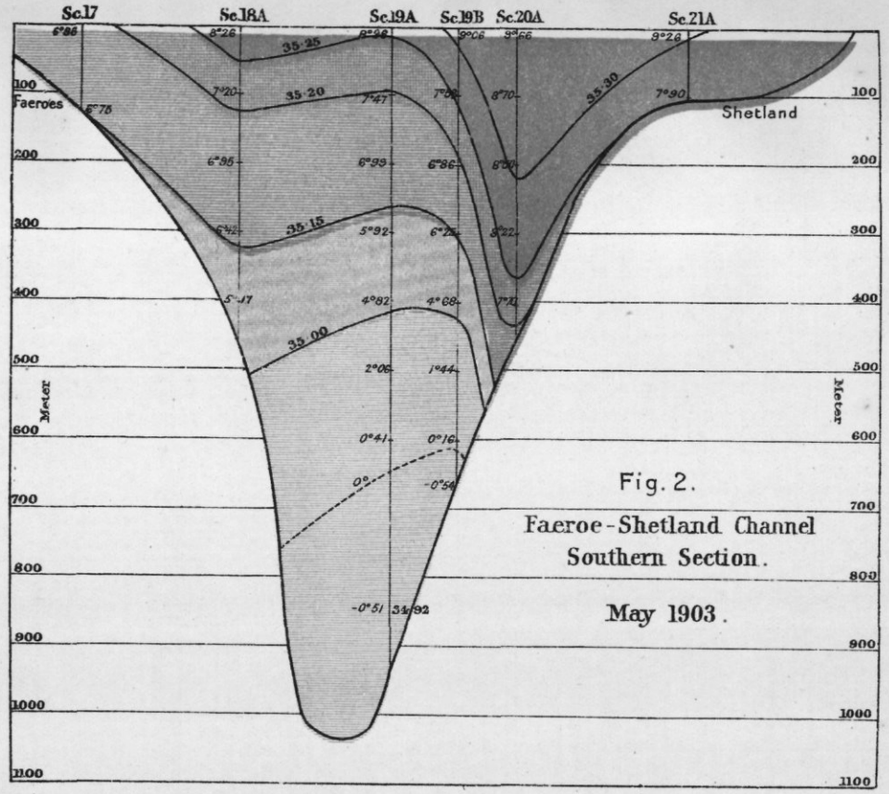


Fig. 2.

Faeroe-Shetland Channel
Southern Section.

May 1903.

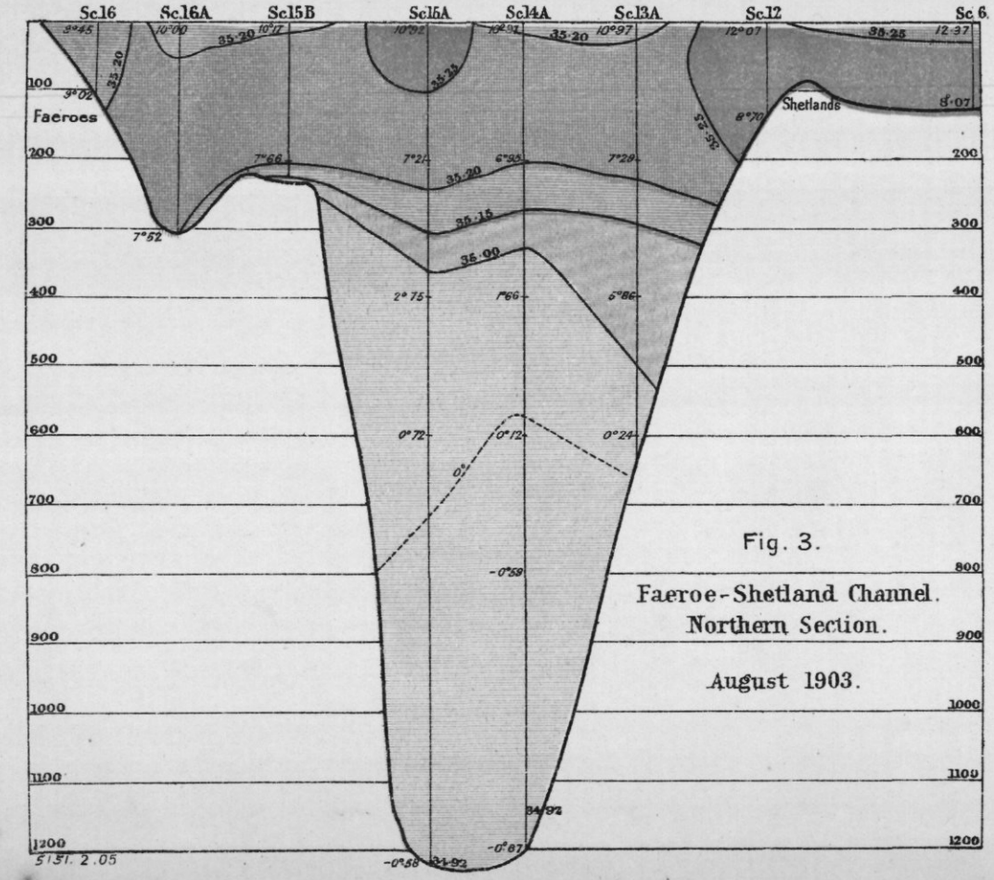


Fig. 3.

Faeroe-Shetland Channel.
Northern Section.

August 1903.

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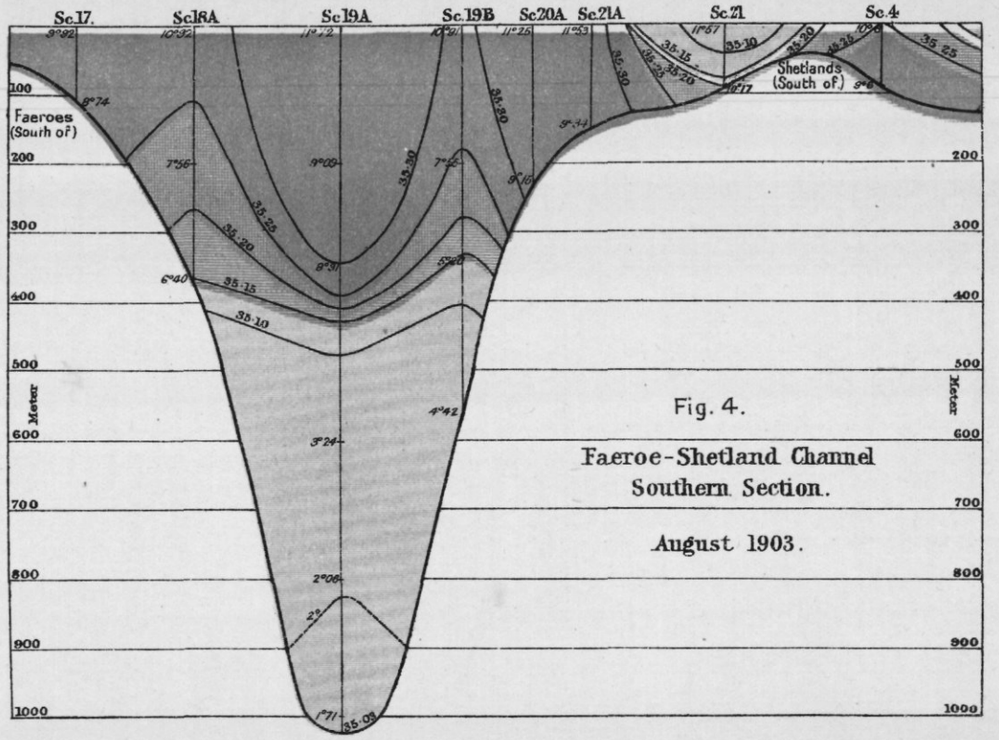

Fig. 4.

Faeroe-Shetland Channel
Southern Section.

August 1903.

Horizontal Scale 1: 3,000,000.
Vertical Scale 1: 10,000.

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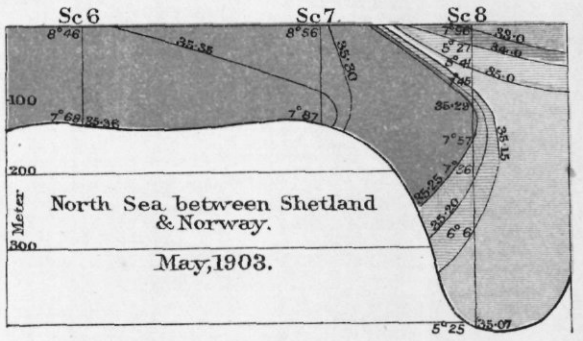


Fig. 1.

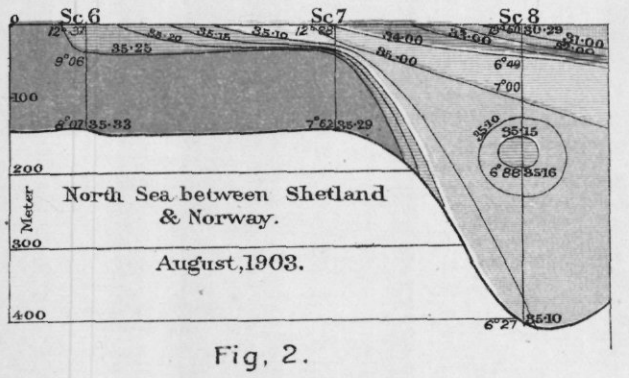


Fig. 2.

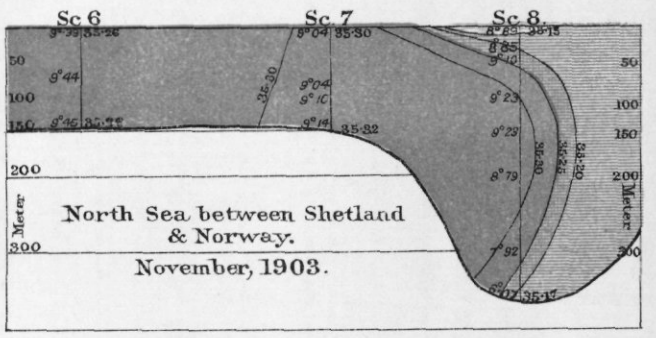


Fig. 3.

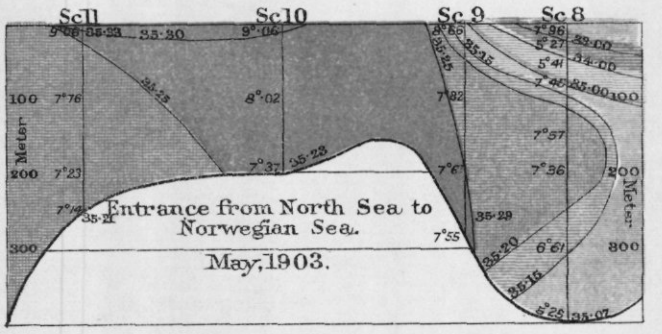


Fig. 4.

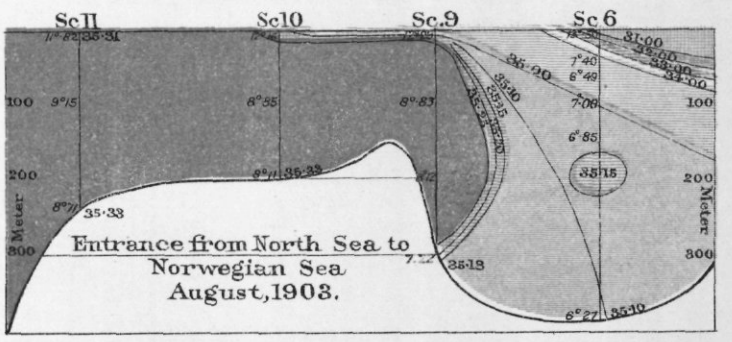


Fig. 5.

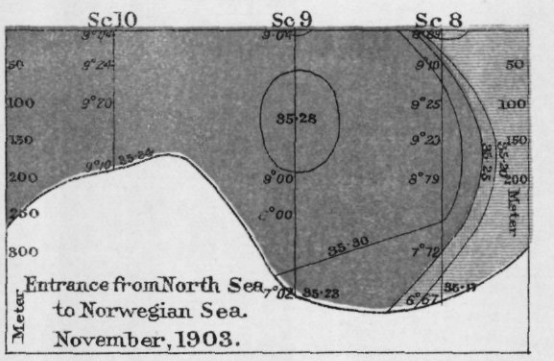
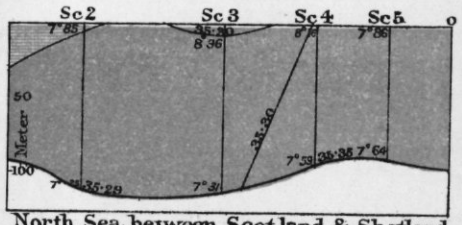


Fig. 6.

Horizontal Scale, 1: 3.000.000.
Vertical Scale, 1: 10.000.

5151 2 05



North Sea beween Scotland & Shetland.
May, 1903.

Fig. 1.

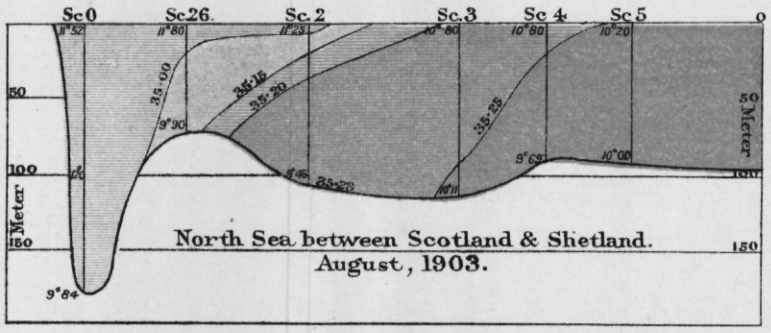


Fig. 2.

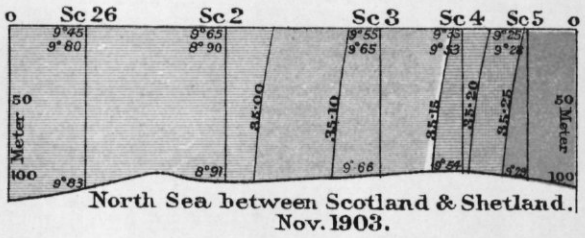
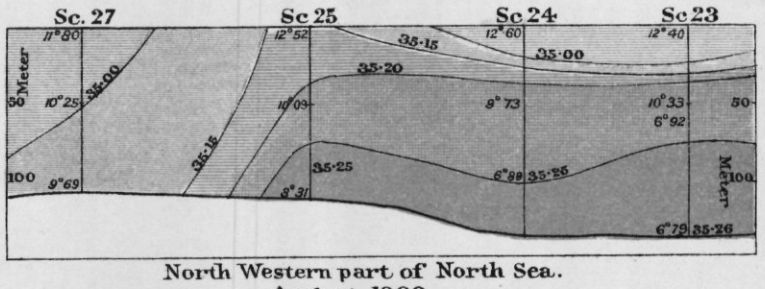


Fig. 3.



Fig, 4.

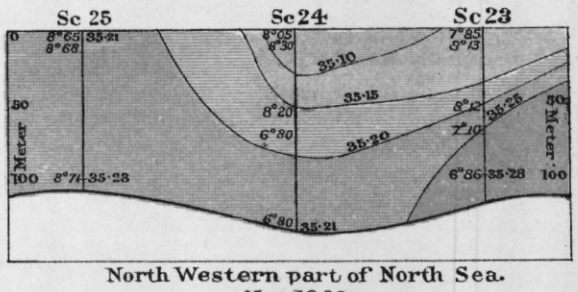


Fig. 5.

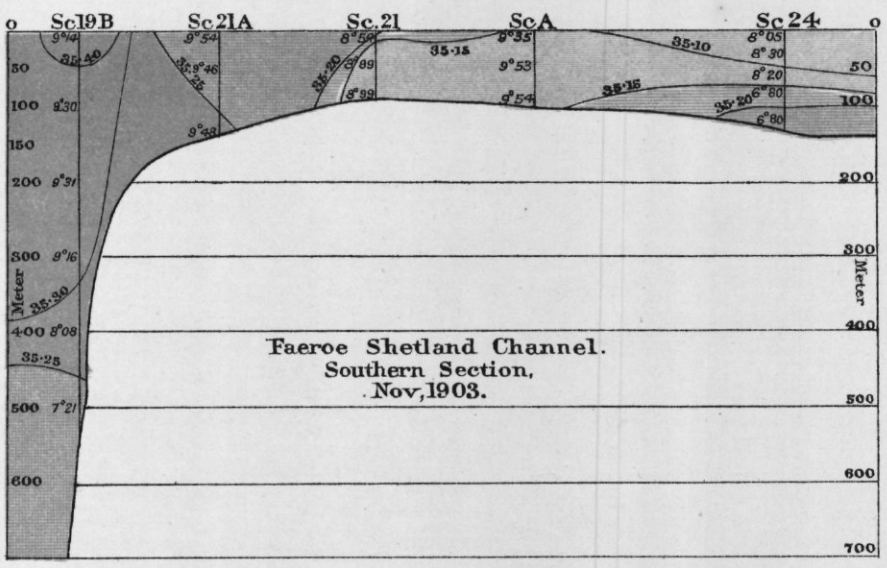


Fig. 6.

Figs. 1 – 5 { *Horizontal Scale, 1 : 3,000,000*
Vertical Scale, 1 : 5,000

Fig. 6. { *Horizontal Scale, 1 : 3,000,000*
Vertical Scale, 1 : 10,000

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