NORTH SEA FISHERIES INVESTIGATION COMMITTEE.

FOURTH REPORT (NORTHERN AREA)

ON

FISHERY AND HYDROGRAPHICAL INVESTIGATIONS IN THE NORTH SEA AND ADJACENT WATERS.

CONDUCTED

FOR THE FISHERY BOARD FOR SCOTLAND

IN CO-OPERATION WITH THE

INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA

UNDER THE SUPERINTENDENCE OF

D'ARCY WENTWORTH THOMPSON, C.B.,

Scientific member of the Board.

1906—1908.

HYDROGRAPHY.

Presented to both Houses of Parliament by Command of His Majesty.

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To ANGUS SUTHERLAND, Esq., C.B.,

Chairman of the Fishery Board for Scotland.

SIR,

Herewith I have the honour to transmit the fourth volume of our Reports upon work done under the Fishery Board for Scotland in connection with the International Investigation of the North Sea and adjacent waters. This volume deals, as did the second of the series, with hydrographical investigations in the North Sea and Faroe Channel, giving an account, together with other matters, of observations made during the years 1906 *to* 1908.

The periodic cruises which we execute by means of the s.s. 'Goldseeker,' on lines laid down by the International Council, continue to be regularly and punctually performed. Meanwhile experience shows, in growing measure, how complicated are the phenomena that present themselves for study in our particular area of the sea, and how notable are the changes, from season to season and from year to year, that these phenomena undergo.

Two papers by Dr. A. J. Robertson deal in detail with the results of the periodic hydrographical cruises of the s.s. 'Goldseeker.' In the first of these papers, dealing with observations made in 1906, *Dr. Robertson continues to discuss the phenomena of the Atlantic Stream, its direction, bulk and velocity, as it passes through the Faroe-Shetland Channel into the Norwegian Sea. Its velocity is estimated at* 12–16 *miles per day, while the counter current at the bottom, of cold slow-moving water from the Norwegian Sea, passes southwards at the rate of* 2–3 *miles per day. While the Atlantic Stream itself appears to be subject to somewhat irregular pulsations, its off-shoots into the North Sea are, as has been already shown, more regularly periodic.*

In a former Report it was shown that the year 1905 *was marked by a conspicuous abnormality as compared with previous years, a great inflow of Atlantic water having come into the North Sea in the winter of that year, at which season the inflow of salt water from the ocean is usually at a minimum. During* 1906, *more normal conditions reasserted themselves; but in a second paper, dealing with our work during* 1907–8, *Dr. Robertson shows that another abnormal phenomenon, of a kind contrary to the former, appeared during the year* 1908. *In the spring of that year, the Atlantic inflow into the North Sea was almost entirely suspended, for the first time since our investigations commenced; and during the whole year Atlantic water was scanty and sparse in the basin of the North Sea.*

A Report by Mr. F. G. Young describes the surface-temperature phenomena of the North Sea for the years 1906–1907, *as ascertained by the invaluable help of the captains of passenger steamers and of the officers in charge of certain lightships and lighthouses. The network of observations that we obtain by the help of these gentlemen enables us to present a complete picture of the temperature of the surface waters throughout the year.*

In another Report I have dealt with similar observations upon surface temperature made by Captain W. Barron between Hull and Hamburg in the years 1877–1883. *The care with which these observations were made, and the long uninterrupted period which they cover, give them an interest which their somewhat remote date does not diminish. These observations enable us to confirm, and in several ways to extend, results already arrived at in regard to the distribution of temperature over the southern parts of the North Sea, and in regard to the correspondence of the sea-temperature in that area with the air-temperature of the adjacent coasts.*

1000. Wt. 13507. 12/08. D & S. 32. 34681.

A valuable Report by Captain C. H. Brown describes experiments which have been conducted by us in the northern part of the North Sea, by means of drift bottles, for the purpose of determining the direction and velocity of the deep currents. By ingenious and simple methods, Captain Brown has clearly demonstrated a system of currents passing down the East Coast of Scotland and eddying northward in a cyclonic course around a centre somewhat to the southward of Bressay Shoal. The interest of this discovery is greatly enhanced by the correspondence of the centre of this eddy with that mass of cold and more or less stagnant water which was discovered in our earliest cruises, and which has several times been described and discussed in these Reports.

Lastly, in another Report, I have attempted to give a general review of the distribution of salinity over the whole of the North Sea, based upon all our work of the past years. The mean distribution of salinity at the surface and at the bottom, and its periodic fluctuations especially in the surface waters, are considered in detail. Certain of the charts given in this paper will be found almost identical with others that have been prepared by Professor Martin Knudsen and his assistants, and which have been published very recently in a supplementary volume of the International Bulletin. The agreement between Professor Knudsen's results and my own is extremely satisfactory, and it is by no means to be regretted that this laborious work of compilation should, in part, have been done twice over by independent hands.

I have, as in former years, to record our hearty thanks to many voluntary assistants, for regular and painstaking observations continued from year to year. The names of these gentlemen, and the observations which we owe to them, are set forth in Mr. F. G. Young's Report contained in the present volume.

The hydrographic observations on board the s.s. 'Goldseeker' have been chiefly under the charge of Mr. George H. Smith, with the regular assistance of Mr. J. Mackenzie, and the frequent help of Mr. Frank G. Young. I beg to record my complete satisfaction with the way in which these members of our staff have carried out the hydrographic cruises of the 'Goldseeker' under Captain Murray's command.

I am,

Sir,

Your obedient Servant,

D'ARCY W. THOMPSON.

University College, Dundee,
August, 1909.

REPORT

ON

HYDROGRAPHICAL INVESTIGATIONS

IN THE

NORTH SEA AND FAEROE-SHETLAND CHANNEL DURING THE YEAR 1906.

BY

A. J. ROBERTSON, D.Sc.

34681

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(With 14 Plates.)

REPORT

ON

HYDROGRAPHICAL INVESTIGATIONS

IN THE

NORTH SEA AND FAEROE-SHETLAND CHANNEL DURING THE YEAR 1906.

BY

A. J. ROBERTSON, D.Sc.

PART I. HYDROGRAPHICAL.

Introductory Remarks.

All the Scottish hydrographical cruises during the past year have been carried out by the "Goldseeker," and the workers on board are to be congratulated on the unvarying success which has attended their joint efforts. The observations have for the most part been taken by Dr. A. Bowman and Mr. Smith, who, together with Captain Murray, have successfully carried through the work on almost every occasion, often in the face of considerable difficulties. During 1906, the arrangements for carrying on the work have been somewhat changed. The cruises in the Faeroe-Shetland Channel were carried out as usual in June and August. Along the lines of stations extending eastwards from the Moray Firth and Firth of Forth, it has, however, been thought sufficient to take observations at two-monthly intervals, instead of once a month as in 1905, while more numerous investigations have been made at those stations lying between Scotland and Shetland. Additional stations have also been worked in the northern and north-western area of the North Sea, this cruise being undertaken at intervals of two months, by Norway and Scotland alternately. Other lines of stations, situated to the west of the Orkneys, were investigated in July and September, these latter observations being intended to supplement the observations obtained from the more northerly regions of the Faeroe-Shetland Channel (Fig. 1.) The valuable work carried on by the Captains of various

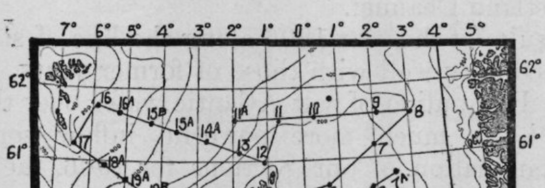


FIG. 1.—Scottish Hydrographic Stations, 1906. Scale 1 : 8,000,000.

passenger ships was continued throughout the year 1906, great assistance being thereby given in the interpretation of the seasonal variations in temperature over the North Sea area.

Apparatus and Methods.

The apparatus employed was for the most part similar to that described in connection with the work of the previous years. Some interesting experiments have been carried out with drift bottles, weighted so as to float just clear of the sea bottom. A large proportion of these bottles is being recovered, and it is hoped that the results when worked up may throw much additional light on what is at present known regarding the deep-water currents.

The Hydrography of the North Sea, 1906, Aberdeen to Shetland (Stations 26–56).

During 1906, observations along the line of stations extending from Aberdeen to Shetland were taken at more frequent intervals than in any previous year, and the material available from this region of the sea is, in consequence, even more complete than formerly. We have, in fact, six pictures of this important area representing the existing hydrographical conditions during February, April, June, July, August and November of the year 1906. A study of these sections taken in order shows that the essential conditions of the waters found to hold good over this region of the sea in former years were again met with during 1906, in other words, the seasonal variations already established regarding the Atlantic inflow into the North Sea by way of the channels extending between Scotland and Shetland receive additional confirmation from these more recent results.

An examination of the sections in detail shows that towards the end of January (Pl. I. 1), when the first set of observations for the year was taken, the greater area of the sea between Scotland and Shetland was flooded by comparatively fresh water of less than 35·10 per mille salinity, and it was only on passing northwards towards Fair Isle that Atlantic water of high salinity was found. The character of the water underwent a more or less sudden change in the area lying between stations 3 and 4, and from this point northwards to Shetland, the salinity remained uniform at 35·3 per mille, a value corresponding to that of pure Atlantic water.

Two months later, the hydrographic conditions over this area had undergone a complete change, as a glance at the section for April at once shows (Pl. IX. 2). The whole area was then flooded by salt Atlantic water, which extended some 80 miles further southwards than in the previous February and which even entered inside the Moray Firth, resulting in a considerable increase in the salinity of the waters in that area.

We are here dealing with the powerful inflow of salt Atlantic water which the results of the past three years have led us to believe takes place sometime in late spring or early summer, and which, in the light of the experience of four consecutive years, may now be looked upon as a well-established, normal, seasonal variation, brought about in some way by the relative distribution during the preceding months of the various waters in the region of the Faeroe-Shetland Channel.

So far, then, the results of the year 1906 along the line of stations between Aberdeen and Shetland agree exceedingly well with those of former years. In each case, there has been a somewhat scanty distribution of salt Atlantic water over this area at the beginning of the year, followed by a much more powerful inflow some three months later. Proceeding with the examination of our Sections for 1906, the next in order represents the hydrographic conditions over this region of the sea towards the middle of June (Pl. III. 1). The distribution of Atlantic water shows, on the whole, only a very small difference from the preceding April, a slight northward movement of the 35·25 isohaline, combined with a small uniform lowering of the salinity over the whole area, marking the principal changes which have occurred during the interval. Six weeks later, however, there had taken place a marked diminution in the distribution of salt water over this area (Pls. IV. 1, VI. 1), a diminution which continued throughout the succeeding months, till towards the end of November (Pl. VIII. 1) this region of the sea had once again assumed its normal winter character, the limit of 35·25 water having retreated northwards towards Shetland to take up a position intermediate between stations 4 and 5.

We thus have, since the start of the investigations in the summer of 1902, a continuous series of observations which seem to show that the volume of Atlantic water entering the North Sea between Scotland and Shetland is subject to regular seasonal variation, a maximum inflow in spring, followed by a gradual diminution throughout the summer and autumn months to a minimum in the following winter, making up the normal yearly cycle of changes. Taking all the material available into consideration, it would appear that the strong spring influx sets in towards the middle of March and continues till well on in June, the actual maximum probably occurring sometime in April.

A study of the November section for 1906 (Pl. VIII. 1) shows that the strong influx of Atlantic water which flooded a large area of the North Sea during the previous winter has not been repeated, so that we are more than ever entitled, in the light of the evidence for the past five winters, to consider the phenomenon of 1905 as an entirely abnormal one, brought about by unusual hydrographic conditions and unlikely to recur unless these conditions again become favourable to its development.

North-Western Area of the North Sea (Stations 27–23 &c.).

For this important area of the North Sea, we have six sections representing the hydrographic distribution during 1906, these sections showing the conditions existing in February, April, June, July, September and November of that year. In the beginning of February, the greater part of this area north of station 25, was flooded by pure Atlantic water, and the temperature at all stations was practically constant from surface to bottom (Pl. I. 2). The distribution of Atlantic water of high salinity was then, in fact, somewhat more extensive than at the corresponding season of the previous years. Ten weeks later, by the middle of April, water of 35·25 per mille had extended considerably nearer Scotland, its southward limit then lying midway between stations 25 and 27 (Pl. IX. 3). The water in the more northerly part of the section had, moreover, begun to separate into the two layers commonly met with over this area of the sea during summer and autumn, viz. an upper layer of warm water, surmounting a bottom layer of considerably lower temperature. Two months later, this top and bottom separation had become much more marked, the salinity of the surface waters being then of a somewhat lower value, consequent on the westward extension of Continental coast water, which normally sets in during early summer, having reached that area of the sea (Pl. III. 2). As stated in a former report, the seasonal variations in the movement of this fresh coastal water over the surface of the sea have probably an important bearing on fishery questions, these offshore and inshore currents determining to a large extent the distribution of pelagic eggs and larvae over a considerable area of the North Sea basin.

The next section, that for July 1906, shows the hydrographic conditions over the north-western area, but along a line which trends some thirty miles nearer the continental coast. This section extends from station 27 situated in Buchan Deep to station 7*a*, lying midway between the North of Shetland and Norway, and gives a most complete picture of the distribution of the various waters over that area during the summer of 1906 (Pl. IV. 3). Near the coast of Scotland, in the neighbourhood of station 27, we have warm and moderately fresh water of a salinity indicating Atlantic water diluted to a certain extent with North Sea water and water from the Scottish Coast. Passing northwards and eastwards, we find on reaching station 25 that the whole area was flooded by pure Atlantic water of a uniform salinity of 35·25 per mille, there being, however, a marked tendency for a division of the water into top and bottom layers of different temperature. Northwards of station 25, this separation became much more pronounced, resulting in a complete division of the water into two layers, the lower of which, extending from about 50 metres downwards, was some 5°C. colder than the surface waters. The hydrographic conditions over the more northerly part of this area during the summer of 1906 showed, in fact, surface layers containing a considerable admixture of fresh, warm, Continental coast water, overlying large masses of cooled Atlantic water, water, that is, which had reached these latitudes at a former period and had afterwards become cooled down by contact with surrounding colder waters. The lowering of surface salinity gradually became more pronounced on passing northwards from station 25, till the value at station 7*a* had sunk slightly below 35 per mille. The surface water at this station must, accordingly, have at that time contained a considerable proportion of fresh water from the Continental coast.

When observations were next made over this area some six weeks later, in September, several changes had already set in (Pl. VI. 3). The Continental coast water had apparently begun to move eastwards, as evidenced by moderate high surface salinities even at the more easterly stations. The layers of cold salt bottom water were still found over the greater part of the north-western area, extending as nearly as far southwards as station 25. The drop in temperature from 40 to 60 metres depth at station 23 was very marked, amounting to close upon 5° Centigrade, while the salinity showed a slight corresponding variation on passing from the one water-layer into the other.

Towards the end of November, the cold bottom water was much more limited in area, the normal winter mixing and renewing having apparently set in by that time (Pl. VIII. 2). Its presence was, however, still quite marked in the neighbourhood of station 23, where the temperature from 70 metres downwards remained constant at 6°·5 Centigrade. The salinity over the whole area was then nearly constant at 35·2 per mille, except for a thin bottom layer of slightly higher value, which extended northwards from station 25.

Comparing the sections for 1906 with those of former years, we find that except for certain minor differences which occur in the hydrographic distribution from time to time, they agree remarkably well together. The main seasonal variations found to occur in one year are repeated in the next, and as in the case of the more westerly line of stations extending from Aberdeen to Shetland, we may now regard the changes taking place over this area from season to season as normal and well established, and as likely to recur regularly in future years. Take, as an example, the case of the seasonal distribution of the fresh Continental coast water. Evidence extending over four years furnishes a more or less precise knowledge of the seasonal movements of this important body of water. We now know that during the winter months, when the Baltic is ice-bound, the distribution of coastal water is particularly scanty and almost entirely limited to the immediate neighbourhood of the Continental coast. But with the melting of the ice in spring the Baltic stream increases in volume and flows northwards as an inshore current along the coast of Norway. With a rising of the temperature in early summer, the density of this fresh-water stream becomes lower and lower, and it spreads slowly westward over the North Sea as a surface current, being confined to the upper layers and prevented from mixing with the underlying water by means of its low density. The material obtained during the past four years furnishes a more or less precise indication of the westward distributive extent of this fresh-water flow at any particular season, so that we can now determine the time of its most extensive distribution over any particular area, with all the consequent resulting phenomena, believed to be of great importance in regard to fishery problems.

Or consider again the question of the cold bottom water commonly met with over this region during the summer and autumn months. Briefly stated, since the start of the investigations in 1902, we have found the north-western area of the North Sea to be completely flooded, during late winter and spring, by Atlantic water of uniform temperature and salinity, the only hydrographic change taking place during that time being a gradual cooling-down of the waters as a whole. With the coming of summer, however, a complete separation of the waters into top and bottom layers takes place, the temperature of the deeper waters remaining constant throughout summer and autumn, while the upper layers continue to follow the customary laws of heating and cooling. Towards the beginning of winter, the cold bottom layers begin to change, being apparently partly renewed by convection-mixing with the surface layers and partly swept out by fresh supplies of Atlantic water entering the North Sea. One result of this, as stated in a former report, is that the bottom waters over this area acquire their maximum temperature towards the close of the year, sometime in November or December.

As a result of the four years' material, we now know, with a greater or less degree of accuracy, the limits of this cold bottom water during summer and autumn, a very important point in relation to fishery questions. We know also that it disappears from certain parts of the sea at the beginning of winter, being then apparently swept out and renewed by fresh supplies of Atlantic water from the westward. But what we cannot at present state with certainty is the precise nature of its origin. The question has been already fully discussed in the report for 1904–5 and unfortunately there is no fresh knowledge available which will enable us to add to the explanations there given. Whether the yearly supply is derived from Atlantic water which has entered the North Sea during the previous winter or whether it belongs to a still earlier date, having reached the north-western area by way of the Norwegian Sea, is a matter which has still to be decided. It had been hoped that analyses showing the proportion of dissolved oxygen in the surface and bottom layers from season to season might have greatly assisted in the solution of this important problem, but unfortunately owing to considerable difficulties experienced with the apparatus employed, it has not been found possible to throw additional light on the subject. A recently-published paper by Fridtjof Nansen* on "Northern Waters" promises to help to elucidate the matter but more evidence is required before any definite conclusion can be arrived at.

WESTERN AREA OF NORTH SEA (STATIONS 28IV–38, 38–41a, 41a–46).

During the year 1906, it has been found sufficient to work the stations over this area every alternate month, instead of monthly, as formerly, and along the Moray Firth line of stations, observations have been taken from every second station only. Along the other two lines, viz., the one extending eastwards from the Firth of Forth, and the one connecting the most easterly point on these two lines respectively, the position and number of the stations have been somewhat changed. The connecting line has been altered in direction so as to pass across a more easterly area of the North Sea, and the Firth of Forth line of stations has been lengthened accordingly. The material available furnishes us with five sets of three sections each, representing the hydrographic conditions existing over this area during February, May, August, October and December, 1906.

Considering first the more northerly line of stations and taking the sections in order, the first represents the hydrographic distribution outside the Moray Firth towards the middle of February, 1906 (Pl. I. 4). At the most westerly station we have, as might be expected, water of low salinity, indicating a considerable proportion of fresh water from the Scottish coast. The salinity gradually increased on passing towards Norway, and from station 34 eastwards to station 38 we find the whole area flooded by water of 35·25 per mille, which marks the southward flow of Atlantic water into the North Sea. When the next observations were taken ten weeks later, the volume of 35·25 water had somewhat decreased, and there was a distinct indication of the presence of Continental Coast water in the more easterly part of the section, the water of maximum salinity passing station 34 in the form of a wedge, bounded on either side by slightly fresher water. The separation into surface and bottom temperature layers, commonly met with during the summer months in the easterly part of this section, was just beginning to take place at station 38 when the May observations were taken (Pl. II. 2). The section for August (Pl. V. 1) shows this separation at a later stage, when the waters were divided into two sharply-defined strata, prevented from mixing by reason of their great difference in density. The presence of coastal water was still shown by a slight lowering of the surface salinity at station 38, where there was found an upper warm layer of 35·16 per mille, surmounting much colder bottom water of 35·28 salinity.

The observations taken some eight weeks later show that considerable changes had taken place in the hydrographic conditions during the interval (Pl. VII. 1). Over the whole area, the upper layers were now composed of water of comparatively low salinity, the surface values at stations 34, 36 and 38 rising only very little above 35 per mille. Underlying this fresh surface layer, there was still found the usual cold bottom water of high salinity, which was, however, much more limited in area than in the preceding August, the normal winter mixing and renewing already referred to having evidently begun to take place. Two months later, towards the middle of December, this high density water had shifted still furthur eastwards and was then only visible at station 38, the most easterly point in the section.

Comparing the 1906 observations with those of the previous year, we observe that the more important changes shown in the one year are repeated in the next, although certain minor differences, such as the large proportion of fresh water in the surface layers during last October, are found to exist. As previously explained, this region of the sea provides an excellent means of studying the seasonal distribution of three waters of widely different character, viz., the inflowing Atlantic Stream, the surface flow of Continental coast water and the movements of the more or less sluggish cold bottom water, the precise origin of which cannot at present be determined with certainty. As the result of the work of the past two years, we may conclude that the greater part of this area of the sea is normally flooded, during the winter and spring months, by water of high salinity and uniform temperature from surface to bottom, the salinity of the water in the more easterly part of the section corresponding to that of pure Atlantic water, and marking the southward flow of the Atlantic Stream into the North Sea. Later in the year, the waters over a considerable part of the section begin to separate into two layers of widely-different temperature, while fresh water from the Continental coast begins to creep westwards and to appear at the most easterly stations. With the coming af autumn and winter, the fresh surface water once more recedes towards the coast of Norway, while a process of mixing and renewing, rendered easier by the lowering of the temperature of the surface waters, begins to take place. This renewing becomes more and more vigorous onwards till the close of the year, resulting finally in a complete equalisation of temperature from surface to bottom over the whole area.

The next sections to be considered are those representing the hydrographic conditions along a line of stations, situated some hundred miles east of the Aberdeenshire coast and running nearly parallel to it, approximately in the meridian of 1° E. The stations along this section are four in number (38, 39*b*, 40*b* and 41*a*) and lie slightly nearer the Continental coast than the corresponding ones investigated during 1904–5.

The hydrographic distribution over the more northerly part of this area usually agrees pretty closely with that existing at the more easterly stations in the Moray Firth section. Thus, in February 1906, the Atlantic inflow which flooded the latter section from station 34 eastwards cut this vertical section in the neighbourhood of station 40*b*, these two stations marking respectively the approximate westward and southward limits of the Atlantic inflow over that region of the sea during February 1906 (Pl. I. 5). As might be expected, the salinity showed a gradual falling-off on passing southward along the section, the value at station 41*a* being still, however, as high as 35·16 per mille. Three months later, the presence of Continental coast water had begun to make itself felt along this section, the surface salinity showing a slight decrease at all stations (Pl. II. 3). The temperature of the bottom water was under 6° C. over the whole area, and the water of highest salinity was found in the bottom layers at stations 38 and 39*b*, where its value was slightly over 35·2 per mille.

The next section, that for August 1906, shows conditions similar to those already described in connection with the Moray Firth line of stations (Pl. V. 2). We again have a wedge of salt Atlantic water, reaching to the surface in the region between stations 38 and 39*b*, and bounded on either side by water of lower salinity, on the north by Atlantic water slightly diluted by Continental coast water, and on the south by typical North Sea water of 35 per mille. This section for August brings out two points very clearly, viz., that the Atlantic flow in the southward movement bends round and away from the Scottish coast, and that the Baltic overflow, in spreading westwards over the surface of the North Sea, has a slight northward motion imparted to it by the rotation of the earth. Its effect was, in consequence, more marked at station 38 than at station 39*b*, the latter point, although lying slightly nearer the Continental coast, being evidently outside the direct flow of the fresh-water current. During August, the temperature of the bottom water decreased on passing southwards, the coldest water being found at station 41*a*, where it was some half-degree lower than at station 38.

The section for October (Pl. VII. 1) showed, in common with the more northerly one extending eastwards from the Moray Firth, a considerable decrease of salinity over the whole area, the distribution of salt Atlantic water over that area being then particularly scanty. Two months later, towards the middle of December (Pl. VIII. 4), the whole region was once more flooded by water of 35·2 per mille and upwards, although 35·25 water existed only in the most northerly part of the section and there only in the deeper layers. The two December sections for this area (Pl. VIII. 3, 4) still show a small mass of cold bottom water of 7° C. and under, the southward limit of which then extended only as far as Station 39*b*. It is worthy of note that while this low temperature still existed in the bottom layers at Stations 38 and 39*b*, the water at Stations 40*b* and 41*a* had acquired a uniform value at all depths, this being due, in a certain degree at least, to the shallower nature of the sea at these latter stations, which allowed of a more rapid and complete mixing of the surface and bottom layers by means of convection currants.

The remarks given above in discussing the seasonal changes along the Moray Firth line of stations hold good also in connection with the area of the sea now being considered. These two vertical sections are specially valuable as affording an accurate indication of the westward and southward seasonal limits of the waters of various origin normally present in this region of the sea. Thus by combining the two sections for any particular month, we are enabled to see at a glance the volume of salt Atlantic water passing southwards along this area and to determine with a certain degree of accuracy the boundary of its westward extension towards the Scottish coast. We are also enabled to define the westward and southward limits of the cold salt bottom water and of the fresh warm coastal water present at any particular time in this region of the sea, and to compare from season to season their relative abundance with that of the inflowing supplies from the Atlantic.

The sections extending eastwards from the Firth of Forth will next be shortly considered. As might naturally be expected, the salinity usually shows a gradual increase on passing eastwards away from the Scottish coast, the maximum salinity being generally found at the most easterly station. This condition does not, however, hold good during the summer months, when, on account of the westward movement of fresh Continental coast water, the water of maximum salinity is found somewhere in the middle of the section. The greatest proportion of salt water over this area was, therefore, found towards the beginning (Pl. I. 3) and end (Pl. VIII. 5) of the year, when the salinity of the two most easterly stations corresponded with that of fairly pure Atlantic water. During August (Pl. V. 3), on the other hand, when the Continental coast water appeared to have had its most extensive westward distribution, the salinity hardly rose above 35 per mille at any point along this section, the surface value at station 41*a*, the most easterly point, only reaching 34·99. The temperature of the water in the deeper layers showed, during the summer and autumn months, a marked falling-off on passing from the Firth of Forth eastwards (cf. Pls. II. 4, V. 3, VII. 3), the maximum differences in August and October 1906 amounting to some 5° Centigrade. In common with the cold bottom water found at the more northerly stations, the temperature over this area normally assumes its maximum value towards the close of the year, the bottom temperature at station 41*a* being some 1·5° C. higher during December 1906 than at any other time of the year. From December (Pl. VIII. 5) onwards till April, the temperature over this area apparently remains quite uniform from surface to bottom, the only change taking place during that time being a gradual cooling down of the water as a whole to a minimum sometime in March or April.

Hydrography of the North Sea between Shetland and Norway during 1906.

During the past year, a new line of stations (5*b*–7*a*), running from the north of Shetland towards Norway in a due easterly direction, has been worked by Scotland on three occasions, viz., in April, July and the beginning of September, and the resulting sections, taken in conjunction with those obtained from the older line of stations (6, 7 and 8) during April and September, furnish an interesting series of pictures of the hydrographical changes taking place over that area during the summer and autumn of 1906.

The first sections to be considered, those for the middle of April (Pl. II. 1), show that the entire region of the sea extending some 100 miles eastwards from Shetland was then flooded, at all depths, by pure Atlantic water of 35·3 per mille and upwards. At station 7*a*, the eastward limit of the more southerly line of stations, no falling-off whatever in the salinity was shown, so that Continental coast water was then mainly confined to the inshore regions near the coast of Norway. Its influence had, however, begun to make itself felt between stations 7 and 8 in the more northerly section (Pl. IX, 1), the surface salinity at station 8 being then as low as 34·18 per mille.

The next section, representing the conditions over this area towards the end of July (Pl. IV. 2), shows that this fresh coastal water had in the meantime extended somewhat farther westwards, resulting in a marked lowering of the surface salinity at station 7*a*, where the value was then just under 35 per mille. This decrease of salinity was entirely confined to the uppermost 30 metres, the bottom regions being still flooded by salt Atlantic water of 35·28 per mille. The hydrographic distribution showed, in fact, a thin surface layer of warm fresh Continental coast water surmounting a layer of much colder and salter Atlantic water, the changes in temperature and salinity shown on passing from the one water-layer into the other being very marked at about 30 metres depth.

At the beginning of September, the influence of coastal water was shown as far westwards as station 6, situated only some 30 miles east of the Shetland coast (Pl. VI. 2). Its distribution was at that time probably near its annual maximum, the greater part of the northern area of the North Sea being then covered by a thin surface layer extending to a depth of about 30 metres. While its effect on the salinity was not very marked along the more southerly line of stations, it produced a marked diminution over the area to the immediate northward, the surface salinity at station 8 falling as low as 31·35 per mille.

Observations from the area of the sea during the last four years show that the distribution of Continental coast water over the North Sea area is most certainly subject to seasonal variation, and although its volume and distributive extent may vary somewhat from year to year, yet its movements appear to be controlled and governed by the same natural laws. As we have already seen, its distribution during the earlier part of the year is very limited and its effect is then mainly confined to the inshore waters near the Norwegian coast. While this is partly due to the diminished Baltic outflow during the winter months, the chief factor to be taken into account is the very low temperature at that season of the waters in the immediate neighbourhood of the Continental coast.

This assists the action of convection currents in bringing about a more or less complete mixing of the fresh surface layers with the underlying salter water, so that the effect of coastal water is then almost entirely confined within the area of the deep channel off the Norwegian coast. On the approach of summer, the temperature of the Baltic water rises, its density in consequence becomes less, so that its immediate mixing by convection currents is no longer possible and it spreads out over the North Sea as a thin surface layer. From the changes in temperature and salinity at various points during summer and autumn, we are enabled to follow its westward movement away from the Continental coast, to determine more or less accurately its season of maximum distribution and finally to observe the retrograde movement which begins to take place later on in the year and continues till well on in the following winter. As already stated, these offshore and inshore movements of coastal water, which appear to be subject to seasonal variation and to be co trolled by the same natural laws are probably of extreme importance in connection with the distribution of eggs and larvae over the northern area of the North Sea. A complete understanding of these seasonal changes may accordingly be expected to throw light on some intricate fishery problems, notably that in connection with the migration of the herring.

Hydrography of the Entrance from the North Sea to the Norwegian Sea during 1906.

The line of stations (11*a*-8) situated in the area at the entrance from the North Sea to the Norwegian Sea has now been extended to include a new station 11*a*, situated within the deep channel some 50 miles north-west of Shetland. Observations were taken over that region on two occasions during the summer of 1906, and sections have been drawn showing the hydrographical conditions existing there during April and September.

The first section to be considered is that representing this region of the sea towards the middle of April (Pl. IX. 4). As might be expected, the western part shows conditions very similar to those commonly existing in the Faeroe–Shetland Channel, viz., surface layers of salt water marking the northward flow of the Atlantic stream, and bottom layers of cold, dense water, marking the southward movement of Norwegian Sea water towards the Faeroe–Shetland Channel. At the more easterly stations, 8 and 9, there were the usual indications of Continental coast water, as shown by the decreased temperature and salinity in the surface layers.

As already mentioned, the lowering of salinity at station 8 was very marked in the beginning of September, when the surface value fell as low as 31·35 per mille (Pl. X. 2). The greater part of the section was then, however, flooded in the surface by water of high salinity, indicating the northward flow of the Atlantic stream towards the Norwegian Sea. A slight lowering of the salinity in the upper layers was probably due to the presence of surface water from the Norwegian Sea, which at that time apparently moved southwards into the regions north of the Faeroe–Shetland Channel. The bottom layers in the western part of the section were, as usual, composed of the cold water from the Norwegian Sea basin which normally floods the deeper regions north of the Faeroe-Shetland Channel and which extends as far southwards as the Wyville–Thomson ridge.

Hydrography of the Faeroe–Shetland Channel during April—June, 1906.

We now pass on to a consideration of the sections dealing with the hydrographical conditions existing in the neighbourhood of the Faeroe–Shetland Channel during the summer of 1906. From the material available, sections have been drawn showing the distribution of temperatures and salinities in the northern and southern sections of the Channel for June and August (Pls. XI., XII.), and also over a more southerly area in the North Atlantic for July and September (Pls. XIII., XIV.). The section across the entrance from the Norwegian Sea to the North Sea has, as already stated, been extended into the deep water north of the Faeroe–Shetland Channel, and the sections over that area for April and August ought to materially assist us in understanding the seasonal changes going on in this important region of the sea.

Taking the sections in order, the first is that already alluded to representing the hydrographic conditions during April over the region some 50 miles north of Shetland, which constitutes, as it were, the boundary between the North Sea and the Norwegian Sea (Pl. IX. 4). The western part of this section was then flooded to a depth of about 250 metres with pure Atlantic water of high salinity, marking the eastern limit, during that month, of the northward-flowing Atlantic Stream on its way towards the Norwegian Sea. Underlying this surface flow of northward-moving water there was again found, from a depth of 500 metres downwards, the usual cold bottom water of 34·94 salinity, water which passes southwards from the Norwegian Sea basin towards the Wyville–Thomson ridge.

The next sections, drawn from observations taken in the Faeroe–Shetland Channel during June, give two complete pictures of the conditions existing in the northern and southern areas towards the middle of that month (Pl. XI.). An examination of the two sections at once reveals some striking differences. Thus the southern area was then apparently largely flooded by salt Atlantic water of 35·3 per mille and upwards, while along the parallel line of stations, some 70 miles to the northward, no water of so high a degree of saltness was found. The most highly saline water present over the northerly area was, moreover, exceedingly limited in extent, and was exclusively confined to the Shetland side of the Channel. The conditions existing in the Faeroe-Shetland Channel during June 1906 were, in fact, very similar to those found to hold good during August of the two preceding years. The explanation then given was that this apparently anomalous distribution of salt Atlantic water was entirely due to its direction of flow across channel, so that the southern section passes *along* the direction of the stream and the northern section *across* it. The Atlantic stream thus apparently entered the Faeroe-Shetland Channel during June 1906 by passing *south* of the Faeroes, and preserved a north-easterly direction of flow in crossing towards Shetland, so that a section across the southern area of the channel gives an exaggerated idea of its actual volume. On nearing the eastern side of the Channel its direction apparently changed into a more northerly one, so that its waters crossed the northern section close to the Shetlands.

The deeper layers of the Channel were, as usual, composed of cold Norwegian Sea water of less than 35 per mille salinity, the bottom temperature during that part reaching as low as −0·9 Centigrade. Owing to the more limited distribution of Atlantic water in the northern regions of the Channel, the effects of this underlying water reached very near the surface, giving rise to an apparent division of the Atlantic Stream into two branches. The surface temperature and salinity were, in consequence of this peculiar distribution of Atlantic and Norwegian Sea water, of minimum value in the central regions of the Channel.

JUNE 1906.

—	Station 15*b*.		Station 15*a*.		Station 14*a*.	
Depth.	Temp.	S.°/₀₀	Temp.	S.°/₀₀	Temp.	S.°/₀₀
0	8·75	35·26	8·55	35·19	8·75	35·26
100	6·80	35·19	5·47	35·05	6·79	35·19
250	6·54	35·19	1·76	34·92	5·79	35·12

As stated in dealing with the report for 1904-5, it seems likely that this peculiar distribution in the northern regions of the Channel is not, as has sometimes been supposed, due to a real division of the Atlantic Stream by a cold-water wedge from below, but is simply caused by the more or less winding flow of the Atlantic water in crossing the Channel towards the Shetlands, so that its effect is less marked at some points in the northern section than at others. This would account for the lowering of temperature and salinity at station 15*a*, which, in June 1906, was apparently situated just outside the main flow, and where, accordingly, the influence of the cold, fresh, underlying Norwegian Sea water would become of more effect.

HYDROGRAPHY OF THE NORTH ATLANTIC, JULY 1906.

The observations taken in the North Atlantic some three weeks later (in the beginning of July) illustrate some points of interest (Pl. XIII.). The flow of the Atlantic Stream towards the regions of the Faeroe-Shetland Channel had evidently altered somewhat in direction since the previous observations, and was now running in a more northerly direction than was the case a month previously. Its eastward limit over this area was now marked by stations 50 and 56, and its waters appeared to pass quite close to the Hebrides and to flow towards Shetland in an almost north-easterly direction. Westwards of the line joining these two stations, the whole section was flooded at all depths by warm Atlantic water of high salinity, the temperature and salinity at 1000 metres depth being 8° Centigrade and 35·3 per mille respectively. These numbers are in marked contrast to the values found some fifty miles northward in the regions of the Channel, where the bottom is normally flooded by very cold water of some 34·9 per mille salinity. The difference is, of course, determined by the Wyville-Thomson ridge which, while allowing of the northward flow of the surface waters of the Atlantic Stream, completely bars the southward progress of the cold bottom water proceeding from the Norwegian Sea basin.

Hydrography of the Faeroe–Shetland Channel, August 1906.

The next sections to be considered are those representing the conditions of the waters in the Faeroe–Shetland Channel towards the close of August 1906 (Pl. XII.). The observations for that month show that the Atlantic Stream still preserved the more northerly direction of flow assumed by it in the beginning of July. A glance at the sections for June and August will make this point clear. In considering the hydrographical conditions of this area in June, we concluded from a study of the two sections that the Atlantic stream then entered the channel south of the Faeroes flowing in an easterly direction towards Shetland. These conditions no longer held good, however, when the August observations were taken The water of maximum salinity was then equally distributed in both the northern and southern regions of the channel and was, moreover, entirely confined to the Shetland side leading to the increase of salinity north of Shetland (Station 12) which is further illustrated in Pl. III. 3, 4. We may thus assume that the Atlantic stream no longer entered in an easterly direction of flow, but that it passed northwards or north-eastwards from the vicinity of the Hebrides and crossed both sections of the channel close to the eastern side. The distribution of Norwegian Sea water was also very similar in both sections during this month, this condition being in marked contrast to that for the preceding June, when, on account of the more extensive Atlantic distribution along the southern area of the channel, its effect was much more pronounced in the more northerly regions. During August, there appeared to be, in fact, a southward movement at all depths of water from the Norwegian Sea into the central and western areas of the channel, the values of temperature and salinity showing a considerable falling-off on passing westwards outside the flow of the Atlantic stream.

The observations taken at the same time some 40 miles north of Shetland, along a parallel section crossing the entrance from the Norwegian Sea to the North Sea, show some points of further interest (Pl. X. 1). The surface of the sea to a depth of about 50 metres was then flooded by water of slightly reduced salinity, indicating, evidently, a small dilution of the salt Atlantic water with surface water from the Norwegian Sea. The proportion of Norwegian Sea water present was not, however, sufficient to lower the temperature to any marked extent; the volume of this surface water was, however, considerable, and extended eastwards nearly to station 9, situated some 100 miles off the Norwegian coast. Underlying this upper layer of warm and fairly pure Atlantic water there was found water of the same degree of salinity as in the more easterly part of the Faeroe-Shetland Channel, this mass of 35·3 per mille water, some 250 metres in thickness, marking the northward flow of the Atlantic Stream on its way towards the Norwegian Sea. The bottom water over this area was similar to that present in the more southerly regions of the channel and consisted of the usual cold, heavy water from the Norwegian Sea basin.

The last sections for the year are those constructed from observations taken in the North Atlantic area towards the middle of September (Pl. XIV.). The distribution of salt Atlantic water over this region was then more limited than when the previous investigations were carried out two months previously. The section including stations 49 to 52 was again, however, largely flooded by salt Atlantic water, which extended eastwards nearly to station 51. The deeper stations in this section, being situated south of the Wyville-Thomson ridge, were as usual flooded at all depths by pure Atlantic water, the temperature and salinity values at 800 metres being 8°·1 Centigrade and 35·3 per mille respectively. Additional observations were taken, during the cruise, along a line of stations some 20 miles to the northward of the section last considered, and situated just beyond the Wyville–Thomson ridge. A glance at the two sections illustrates the well-known importance of this submarine barrier in determining the hydrographic distribution over this area, more especially in relation to the waters present in the deeper layers. Station 52, as we have just seen, was then flooded at all depths by warm Atlantic water of high salinity, the value at 800 metres depth being as high as 35·3 per mille. Station 52*d*, on the other hand, lying to the immediate northward of the Wyville–Thomson ridge, showed an entirely different hydrographical condition, the whole area from 400 metres downwards being flooded by cold Norwegian Sea water of less than 35 per mille, similar to that found in the deeper layers of the Faeroe–Shetland Channel.

The limits of the distribution of 35·3 per mille water along the three sections investigated leads us to suppose that the Atlantic Stream was during that month flowing over this area in an almost easterly direction towards the North Sea, and it was apparently only at a later stage that its direction of flow changed into a north-easterly one, so that it crossed the Faeroe–Shetland Channel close to Shetland, and subsequently cut the more northerly section at the entrance to the Norwegian Sea.

Summary.

The work in connection with the International Investigation of the North Sea and surrounding waters has now been proceeding for upwards of four years, and during that time much interesting and valuable information has been acquired regarding the seasonal distribution and relative abundance of the different waters normally present in these regions. Sufficient evidence is now available to enable us to consider several of the hydrographic changes which have been found to take place during that time within the North Sea area as well-established seasonal ones which are likely to be repeated in future years. Partly owing to the absence of winter observations, it is, however, at present difficult to say whether the hydrographical changes in the region of the Faeroe–Shetland Channel are really subject to seasonal variation or not.

The results of the Scottish investigations may shortly be summarised as follows :— Large volumes of Atlantic water are constantly streaming northwards as a surface current through the Faeroe–Shetland Channel into the Norwegian Sea. The most extensive distribution in and around the regions of the channel appears to take place some time in late spring or early summer, and the volume, direction and rate of flow of this salt Atlantic Stream are subject to considerable variation from season to season and from year to year. The volume of Atlantic water streaming northwards through the channel does not appear to be governed or controlled by any fixed and definite laws, but rather to be subject to the influence of irregular pulsations, which appear to come and go without any visible determining cause. The direction of flow of the Atlantic Stream varies from a more or less northerly one to a due easterly one, and in the latter case the current enters the channel to the immediate south of the Faeroes and preserves into eastward course till quite close to the Shetland side of the Channel. The velocity in the surface layers appears to average some 12–16 miles per 24 hours, so that the actual volume of Atlantic water passing northwards into the Norwegian Sea must be enormous. The main branch of the Atlantic Stream is almost invariably situated in the Shetland side of the channel, where its waters normally extend to a depth of some 300–400 metres.

Along the bottom of the Channel, cold, dense Norwegian Sea water is constantly pressing southwards towards the Wyville–Thomson ridge. That this water is not actually stagnant is shown by the small changes in temperature which take place from time to time even in the deepest layers, but its rate of progress is apparently very slow and probably averages only some 2 or 3 miles per day.

The Atlantic Stream, in its northward passage towards the Norwegian Sea, throws out offshoots of salt water which enter the North Sea through the channels south of Shetland. The volume of this inflow varies greatly from time to time and appears to be subject to periodical increase and decrease dependant on the seasons. A particularly scanty salt-water distribution at the beginning of the year is normally followed by a vigorous Atlantic inflow which increases to a maximum towards the middle of April, when the whole north-western area of the North Sea becomes flooded by water of high salinity. Throughout May and June, this powerful Atlantic influx apparently continues with but slightly abated vigour.

From that season onwards, however, a gradual falling-off sets in, water of high salinity recedes farther and farther northwards towards Shetland, and a minimum is finally reached towards the middle of winter, when the distribution of Atlantic water over this area of the sea becomes extremely limited. The only exception to this apparently normal yearly cycle of changes was experienced during the winter of 1905, when the hydrographical conditions indicated an extensive inflow of Atlantic water, corresponding to that usually found to exist at the season of maximum distribution. This strong salt-water winter influx was, however, apparently entirely abnormal in character, being probably brought about by an unusual arrangement of atmospheric conditions, and may, accordingly, be regarded as unlikely to be repeated regularly in future years.

Another problem on which much light has been thrown during the International scheme of work is the seasonal variation in the movements of fresh coastal water over the surface of the North Sea area. During late spring, we normally find the greater part of the northern and north-western areas of the North Sea flooded at all depths by salt Atlantic water. But with the coming of summer heat, we find Scottish coastal water on the one hand and fresh Continental coast water on the other gradually creep out over the surface of the sea and encroach on the dominion previously occupied entirely by water of high salinity. We thus have, during the summer and autumn months, a large area of the North Sea flooded by a thin surface layer of warm, brackish water, surmounting thicker masses of much colder and salter Atlantic water, the two water-strata being prevented from mixing by reason of their great difference in density. On the approach of winter, the coastal waters once more recede backwards towards the inshore regions, leaving the North Sea area largely flooded with water of uniform high salinity at all depths. These coastal waters probably have their most extensive distribution during the month of August, when their influence on the hydrographical conditions over the North Sea is very pronounced. The information obtained throughout the past four years shows that their movements take place regularly from one year to another, and we are now entitled to class this cycle of changes in the category of those subject to seasonal variation and as likely to be repeated regularly from year to year.

During the summer and autumn months a large portion of the North Sea basin is normally flooded, in the deeper layers, by thick masses of cold, dense water, of a salinity which shows it to have been originally of Atlantic origin. Whether this water is derived directly from the Atlantic inflow of the previous winter, having then entered the North Sea south of Shetland and become cooled down by contact with the surrounding colder waters, or whether it is Atlantic water of an earlier date which has reached these latitudes by way of the Norwegian Sea, is a question very difficult to determine. We can, however, determine with a greater or less degree of accuracy the changes which its limits undergo from season to season, a very important matter when considered from the point of view of our fisheries.

As already stated, the relative seasonal distribution of the waters of various character normally present within the North Sea area, viz., the inflowing salt Atlantic water, carrying in solution an abundant supply of oxygen and bearing in suspension a plentiful food supply, the slowly-moving coastal water which largely determines the distribution of pelagic eggs and larvae, and the cold, dense, more or less stagnant bottom Atlantic water of a somewhat earlier date is of great interest and importance in connection with fishery problems, and any fresh evidence tending to throw additional light on this question will be welcomed accordingly.

PART II.—HYDRODYNAMICAL.

Hydrodynamical Treatment of the Conditions of the Faeroe–Shetland Channel during the Summer of 1906.

In order to arrive at some indication of the velocity and direction of flow of the various waters normally present in the region of the Faeroe–Shetland Channel during the past summer, calculations, based on the differences of density of the water as present at the various stations, have been made in as many different ways as possible. The method of carrying out these calculations and of applying the results obtained has been already fully explained in former reports. It may, however, be here stated that the values found represent, not the actual velocities of the current at various depths but the *differences* in rate of flow on passing from the surface downwards, and the maximum values, as has already been explained, are given when the calculations are made along lines vertical to the direction of flow. By finding these velocity-differences in as many different ways as possible we can, accordingly, arrive at a more or less accurate indication of the direction of movement of the waters in question. And in the deeper regions of the sea, as in the neighbourhood of the Faeroe–Shetland Channel, we may, moreover, assume that the bottom waters move only very slowly and so obtain a fair idea of the actual rate of flow of the surface current.

Calculations based on these lines have been made for the Faeroe—Shetland Channel stations in June and August, and also for those situated in the immediate neighbourhood of the North Atlantic for July and September. In reference to calculations carried out across Channel (east to west), positive values indicate that the lighter water was present at the more easterly station ; negative values, for calculations made under similar conditions, indicate that the lighter water was found at the more westerly station. Where the differences of velocity were estimated along the Channel (north to south), 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. In regard to the values obtained from sections in the North Atlantic, the same rules regarding density have been adhered to in determining whether the results found should be tabulated as positive or negative.

FAEROE–SHETLAND CHANNEL, JUNE 1906.

Velocity difference from	Calculated between Stations along Northern Section.					
	16a–16.	15b–16a.	15a–15b.	14a–15a.	13a–14a.	12–13a.
0–30 metres ...	—	—	0·06 cm/sec	—	—	0·40 cm/sec
0–40 „ ...	0·54 cm/sec	–0·75 cm/sec	0·06 „	–0·26 cm/sec	0·20 cm/sec	0·37 „
0–60 „ ...	—	—	0·04 „	—	—	—
0–80 „ ...	—	—	—	—	—	0·19 „
0–100 „ ...	1·04 „	–1·20 „	– 0·75 „	1·71 „	1·31 „	0·13 „
0–200 „ ...	1·00 „	–0·80 „	– 3·52 „	5·31 „	2·29 „	—
0–300 „ ...	—	—	—	—	3·71 „	—
0–400 „ ...	—	—	—	12·92 „	6·08 „	—
0–500 „ ...	—	—	–14·37 „	—	8·93 „	—
0–600 „ ...	—	—	—	14·43 „	11·01 „	—
0–700 „ ...	—	—	–15·96 „	—	—	—
0–800 „ ...	—	—	—	14·26 „	—	—
0–1200 „ ...	—	—	—	12·86 „	—	—

FAEROE–SHETLAND CHANNEL, JUNE 1906.

Velocity difference from	Calculated between Stations along Southern Section.					
	17–18a.	18a–19a.	19a–19b.	19b–20a.	20a–21a.	21a–21.
0–20 metres ...	—	—	—	+0·17 cm/sec	—	—
0–30 „ ...	—	—	—	+0·13 „	—	—
0–40 „ ...	1·24 cm/sec	0·15 cm/sec	0·78 cm/sec	–0·06 „	–0·53 cm/sec	–0·87 cm/sec
0–80 „ ...	—	—	—	—	—	–0·90 „
0–100 „ ...	1·15 „	0·50 „	2·80 „	–2·11 „	–0·85 „	—
0–150 „ ...	—	0·80 „	—	–3·76 „	–1·12 „	—
0–200 „ ...	—	0·90 „	6·43 „	—	—	—
0–250 „ ...	—	0·65 „	—	—	—	—
0–300 „ ...	—	0·23 „	—	—	—	—
0–400 „ ...	—	—	18·42 „	—	—	—

FAEROE–SHETLAND CHANNEL, JUNE 1906.

—	Calculated between Stations in Northern and Southern Section.											
	12a–19a.	13a–19b.	14a–18a.	14a–19a.	14a–19b.	14a–20a.	15a–18a.	15a–19a.	15a–19b.	15b–18a.	15b–19a.	15b–19b.
0–30 metres	+0·13 cm/sec	—	—	—	—	—	—	—	—	—	—	—
0–40 „	+0·12 „	0·41 cm/sec	0·12 cm/sec	0·24 cm/sec	0·58 cm/sec	0·53 cm/sec	0·26 cm/sec	0·39 cm/sec	0·71 cm/sec	+0·36 cm/sec	0·41 cm/sec	0·59 cm/sec
0–60 „	+0·05 „	—	—	—	—	—	—	—	—	—	—	—
0–100 „	–0·10 „	0·83 „	0·06 „	0·33 „	1·50 „	0·80 „	0·70 „	1·12 „	2·26 „	+0·42 „	0·65 „	1·46 „
0–150 „	—	—	0·00 „	—	—	1·02 „	—	—	—	—	—	—
0–200 „	–0·37 „	1·74 „	0·00 „	0·42 „	3·10 „	—	1·88 „	2·75 „	5·38 „	+0·20 „	0·68 „	2·72 „
0–250 „	—	—	0·04 „	—	—	—	—	—	—	+0·10 „	—	—
0–300 „	—	—	—	—	—	—	—	—	—	–0·04 „	0·09 „	—
0–350 „	—	—	0·25 „	—	—	—	4·42 „	—	—	–0·37 „	—	4·64 „
0–400 „	—	4·27 „	—	0·23 „	7·80 „	—	—	5 75 „	13·38 „	—	—	—
0–500 „	—	—	—	—	—	—	—	—	—	—	–2·08 „	—
0–550 „	—	—	—	—	—	—	—	6·20 „	—	—	—	—
0–600 „	–3·33 „	—	—	0·05 „	—	—	—	6·20 „	—	—	—	—
0–700 „	—	—	—	—	—	—	—	6·16 „	—	—	–2·98 „	—
0–800 „	—	—	—	–0·05 „	—	—	—	—	—	—	—	—
0–1000 „	—	—	—	–0·12 „	—	—	—	5·61 „	—	—	—	—

North Atlantic, July 1906.

Velocity difference from	50–51.	51–52.	52–53.	53–54.
0–20 metres	—	—	—	−0·05 cm/sec
0–30 „	—	—	—	+0·20 „
0–40 „	+0·26 cm/sec	−0·18 cm/sec	−0·13 cm/sec	+0·45 „
0–60 „	−0·01 „	0·00 „	—	—
0–100 „	−0·55 „	+0·50 „	−0·18 „	+1·53 „
0–180 „	—	—	—	+2·77 „
0–230 „	—	+0·82 „	—	—
0–250 „	—	—	+0·35 „	—
0–500 „	—	—	+0·78 „	—
0–750 „	—	—	+1·51 „	—
0–1000 „	—	—	+4·53 „	—

Faeroe–Shetland Channel, August 1906.

Velocity difference from	Calculated between Stations along Northern Section.					
	16a–16.	*15b–16a.*	*15a–15b.*	*14a–15a.*	*13a–14a.*	*12–13a.*
0–30 metres ...	—	—	+0·04 cm/sec	—	—	—
0–40 „ ...	+0·63 cm/sec	0·26 cm/sec	−0·02 „	1·10 cm/sec	0·20 cm/sec	+0·17 cm/sec
0–60 „ ...	—	—	—	—	—	—
0–80 „ ...	+0·15 „	—	—	—	—	+0·20 „
0–100 „ ...	—	1·67 „	−0·70 „	2·50 „	0·53 „	−0·02 „
0–120 „ ...	−0·96 „	—	—	—	—	—
0–150 „ ...	—	1·48 „	−0·70 „	—	—	—
0–200 „ ...	—	—	−0·60 „	3·90 „	1·26 „	—
0–270 „ ...	—	—	—	6·71 „	—	—
0–300 „ ...	—	—	—	15·70 „	2·57 „	—
0–400 „ ...	—	—	—	—	—	—
0–500 „ ...	—	—	—	—	6·97 „	—
0–600 „ ...	—	—	—	25·85* „	11·30† „	—
0–800 „ ...	—	—	—	32·50* „	—	—
0–1100 „ ...	—	—	—	43·70* „	—	—

* Values below 500 metres probably too high, owing to temperatures at station 14*a* being incorrectly taken (vide Tables).
† Value at 600 metres probably too low, for similar reasons (vide Tables, 14*a*).

Faeroe–Shetland Channel, August 1906.

Velocity difference from	Calculated between Stations along Southern Section.					
	17–18a.	*18a–19a.*	*19a–19b.*	*19b–20a.*	*20a–21a.*	*21a–21.*
0–30 metres ...	—	+0·25 cm/sec	—	—	−0·10 cm/sec	—
0–40 „ ...	0·63 cm/sec	+0·23 „	0·79 cm/sec	−0·32 cm/sec	−0·03 „	−0·24 cm/sec
0–60 „ ...	—	−0·04 „	—	—	—	−0·05 „
0–80 „ ...	—	—	—	—	+0·20 „	—
0–90 „ ...	—	—	—	—	—	+0·86 „
0–100 „ ...	2·23 „	−0·35 „	2·65 „	−3·36 „	—	—
0–125 „ ...	—	—	—	−5·45 „	+4·23 „	—
0–200 „ ...	—	−0·30 „	5·07 „	—	—	—
0–270 „ ...	—	—	9·70 „	—	—	—
0–300 „ ...	—	−2·00 „	—	—	—	—

Faeroe–Shetland Channel, August 1906.

Velocity, difference from.	Calculated between Stations in Northern and Southern Sections.														
	11a–12.	*11a–13a.*	*11a–14a.*	*13a–19a.*	*13a–19b.*	*14a–18a.*	*14a–19a.*	*14a–19b.*	*14a–20a.*	*15a–18a.*	*15a–19a.*	*15a–19b.*	*15b–18a.*	*15b–19a.*	*15b-19b.*
0— 40 metres	0·26 cm/sec	0·23 cm/sec	0·05 cm/sec	− 0·13 cm/sec	+0·12 cm/sec	−0·25 cm/sec	− 0·08 cm/sec	+0·23 cm/sec	0·12 cm/sec	0·19 cm/sec	0·37 cm/sec	+0·70 cm/sec	0·25 cm/sec	0-34 cm/sec	0·55 cm/sec
0— 80 „	—	—	—	—	—	−0·01 „	—	—	0·22 „	—	—	—	—	—	—
0— 100 „	0·57 „	0·88 „	0·35 „	− 0·33 „	+0·51 „	−0·04 „	− 0·21 „	0·85 „	—	0·86 „	0·81 „	1·92 „	0·56 „	0·29 „	1·14 „
0— 125 „	—	—	—	—	—	—	—	—	−0·69 „	—	—	—	—	—	—
0— 200 „	—	1·41 „	0·27 „	− 0·88 „	0·70 „	−0·61 „	− 0·64 „	—	—	0·92 „	0·93 „	—	—	—	—
0— 230 „	—	—	—	—	—	—	—	—	—	—	—	—	0·50 „	−0·10 „	2·34 „
0— 270 „	—	—	—	—	0·78 „	—	—	1·89 „	—	—	—	4·75 „	—	—	—
0— 300 „	—	—	−0·19 „	—	—	—	—	—	—	—	—	—	—	—	—
0— 340 „	—	—	—	—	—	−2·70 „	—	—	—	1·83 „	—	—	—	—	—
0— 400 „	—	2·24 „	−1·16 „	—	—	—	− 5·55 „	—	—	—	0·28 „	—	—	—	—
0— 500 „	—	—	—	—	—	—	—	—	—	—	+0·10 „	—	—	—	—
0— 600 „	—	1·70 „	−6·56 „	−10·88 „	—	—	− 9·65 „	—	—	—	−0·12 „	—	—	—	—
0— 800 „	—	—	—	—	—	—	−12·30 „	—	—	—	−0·35 „	—	—	—	—
0—1000 „	—	—	−4·21 „	—	—	—	−12·50 „	—	—	—	−0·62 „	—	—	—	—

North Atlantic, September, 1906.

Velocity, difference from.	50–51.	51–52.	51–51*a*.	51*a*–51*b*.	51*b*–52.	52*b*–52*a*.	52*a*–52.	52–52*c*.	52*c*–52*d*.	52*b*–52*d*.	52*d*–52*e*.	52*e*–52*f*.	52*f*–52*g*.	52*g*–52*h*.	52*d*–52*h*.	52*d*–52*g*.	51*b*–52*e*.
0— 40 metres ...	−0·32 cm/sec	1·05 cm/sec	0·55 cm/sec	—	—	−0·86 cm/sec	1·10 cm/sec	0·08 cm/sec	—	—	—	—	—	—	—	—	—
0— 50 „ ...	—	—	—	—	—	—	—	—	2·30 cm/sec	0·64 cm/sec	0·7 cm/sec	0·29 cm/sec	0·59 cm/sec	3·67 cm/sec	1·02 cm/sec	0·48 cm/sec	1·84 cm/sec
0— 60 „ ...	—	1·85 „	0·55 „	1·40 cm/sec	0·18 cm/sec	—	—	—	—	—	—	—	—	—	—	—	—
0— 100 „ ...	—	—	—	4·65 „	4·90 „	−1·25 „	6·15 „	−1·37 „	3·95 „	1·41 „	0·77 „	0·69 „	0·46 „	5·28 „	1·47 „	0·69 „	3·08 „
0— 115 „ ...	−0·50 „	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
0— 150 „ ...	—	—	—	—	—	—	—	—	—	—	—	—	—	6·40 „	2·11 „	—	—
0— 165 „ ...	—	5·19 „	−4·40 „	—	—	—	—	—	—	—	—	—	—	—	—	—	—
0— 200 „ ...	—	—	—	8·75 „	—	—	—	—	—	—	0·17 „	4·89 „	—	—	—	1·90 „	4·14 „
0— 355 „ ...	—	—	—	—	—	—	—	—	—	—	—	—	7·20 „	—	—	6·65 „	—
0— 400 „ ...	—	—	—	—	3·46 „	—	14·3 „	−3·77 „	19·7 „	—	—	20·7 „	—	—	—	—	—
0— 500 „ ...	—	—	—	—	—	−1·50 „	—	—	—	—	−1·95 „	—	—	—	—	—	—
0— 520 „ ...	—	—	—	—	—	—	—	—	—	12·92 „	—	—	—	—	—	—	—
0— 600 „ ...	—	—	—	—	—	—	—	+5·26 „	37·8 „	—	—	—	—	—	—	—	—
0— 800 „ ...	—	—	—	—	1·66 „	—	24·5 „	—	—	—	—	—	—	—	—	—	46·8 „
0—1100 „ ...	—	—	—	—	—	—	—	—	—	—	−3·64 „	—	—	—	—	—	—

Faeroe-Shetland Channel, June, 1906.

The density of the water present in the Faeroe-Shetland Channel during June, 1906, showed a gradual increase from the Shetland side towards the Faeroes, indicating a northward motion of the surface waters with a maximum velocity in the upper layers. In the eastern side of the channel, within the area of the Atlantic Stream, the values of velocity-difference were very small in the first few hundred metres, showing that the rate of flow showed only a slight falling-off in the uppermost layers. In the centre of the channel, on the other hand, where the influence of the Atlantic Stream was not so much felt, the values showed a more rapid decrease on passing from the surface downwards, the difference between the rate of flow at the surface and at 400 metres depth in the region between Stations 14*a* and 15*a* then amounting to as much as 13 cm. per second or about 7 miles in 24 hours. The variations from positive to negative in the values found from station to station seem to indicate that the direction of flow of the Atlantic Stream across channel was subject to considerable changes, so that at some points of its course, as in the region between Stations 15*a* and 15*b*, it seemed to be flowing in an almost south-easterly direction.

By considering the values found in the centre of the channel, we may arrive at an approximate value of the rate of flow of the surface water. Thus, in the region between Stations 19*a* and 19*b*, the velocity-difference from 0–400 metres amounted to about 18 cm. per second. If we assume that the Atlantic Stream was there following a due northerly course and that the rate of flow at 400 metres depth was very small, we arrive at the conclusion that Atlantic water was then passing through the channel with a surface velocity of 18 cm. per second, or some 10 miles in 24 hours. As we have already seen that the direction of flow was then not a northerly but a north-easterly one, and as it is almost certain that the water at 400 metres depth was then possessed of a considerable northward motion, this value is probably somewhat underestimated. Taking all things into consideration, we may conclude that the surface rate of flow of the Atlantic Stream on its passage through the Faeroe-Shetland channel towards the Norwegian Sea was, during June, 1906, some 12–14 miles per 24 hours.

North Atlantic, July, 1906.

As we might naturally expect, the velocity-differences calculated for the area south of the Wyville-Thomson ridge show results of quite a different nature. In the region of the Faeroe-Shetland channel, we normally find surface layers of northward-moving Atlantic water surmounting bottom layers of more or less sluggish water from the Norwegian Sea basin, and as the magnitude of the results obtained depend on the *falling-off* in the rate of flow of the waters on passing from surface downwards, we might naturally expect the velocity-differences there to be comparatively great. South of the Wyville-Thomson ridge, however, the Atlantic stream normally floods a large area from surface to bottom, so that the rate of flow is at all depths approximately the same, except for a slight decrease from surface downwards due to the friction of the various water-layers on those lying immediately beneath them. The results found over this area are, accordingly, very small, and are such as to indicate a northward or north-eastward movement of the waters with a velocity which showed only a small diminution from surface to bottom. In the region between stations 52 and 53, the rate of flow at 1000 metres depth was, in fact, only some 2·5 miles per day less than at the surface.

Faeroe-Shetland Channel August, 1906.

The water present over this area in August again showed a slight rise in density on passing westwards across the channel, except near the Faeroe side where it remained nearly constant. This seems to indicate the usual northward flow of Atlantic water in the eastern and central parts of the channel with a probable slow southward movement of water from the Norwegian Sea into the regions around the Faeroes. The rate of flow near the Shetland side was nearly constant in the first 300 metres, but showed a somewhat marked falling-off at greater depths. A glance at the northern section for that month shows that the Atlantic Stream then extended to a depth of about 300 metres in the Shetland side of the channel, and the sudden falling-off in the velocity of the current is seen to be due to the somewhat rapid change from Atlantic to Norwegian Sea water at a depth of 300–400 metres. Owing to the apparently erroneous temperature and salinity results then obtained, due to imperfect closing of the water-bottle at depths below 500 metres, it is impossible to calculate the rate of flow of the Atlantic Stream during that month. It seems, however, to have been then somewhat greater than in the previous June, but the uncertainty of the data which we have to go upon renders this point somewhat doubtful.

North Atlantic, September, 1906.

As stated when dealing with this region of the seas from a hydrographical point of view, the Atlantic Stream during September, 1906, apparently crossed towards Fair Isle flowing in an almost easterly direction, only assuming a more northerly bent in the immediate southward of the Faeroe-Shetland Channel. The section connecting stations 52*b* and 52*d* appeared to cut across the Atlantic flow, so as to show a central wedge of salt water bounded on the southward by Atlantic water of slightly lower salinity and on the northward by a mixture of Atlantic water with water from the Norwegian Sea. As the Atlantic Stream appeared to cross this section almost vertically, we should naturally expect to find high values for the velocity-differences calculated for various depths at the stations along this line. The maximum values were shown over the area lying between stations 52*c* and 52*d*, where there was a falling-off from the surface to 600 metres of some 38 cm. per second. The water present at 600 metres depth at these stations was then Norwegian Sea water of low temperature and salinity, which was probably moving only very slowly and in a southward direction. If we assume that the bottom water was actually motionless, we arrive at the conclusion that the surface rate of flow of the Atlantic stream over that area was, during September, 1906, some 38 cms. per second or about 20 miles per day. If, on the other hand, the bottom water were not actually stagnant but possessed of a slow southward motion, this value will be somewhat too great. Taking all things into consideration, the actual surface velocity of the Atlantic stream would then probably be from 16–18 miles per day, a slightly higher rate of flow than that found in the region of the Faeroe-Shetland Channel during the previous June.

The values for the velocity-differences given from calculations made along the other two North Atlantic sections, viz., those extending eastwards nearly at right angles to the one just considered, were, as a rule, considerably less. This was partly due to the more extensive distribution of Atlantic water in the deeper layers (so that the rate of flow remained more uniform on passing from the surface downwards) and partly to the fact that the Atlantic stream did not then cross the sections vertically but more or less diagonally, for as has previously been explained, the maximum differences of velocity are shown where the calculations are made along lines perpendicular to the direction of flow of the current. The highest values in the more northerly section were shown between Stations 52*e* and 52*h*, the decrease of velocity from 0 to 400 metres in the region extending between Stations 52*e* and 52*f* then amounting to as much as 21 cm. per second, or about 12 miles in 24 hours. When it crossed this latter line of stations, the Atlantic stream appeared to have developed more of a north-easterly direction of flow and to be moving towards the eastern side of the Faeroe-Shetland Channel on its way towards the Norwegian Sea.

TABLES.

STATION SC. 2.

Latitude, 58° 36′ N. ; Longitude, 1° 46′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 23/i, 10h. 40m. a.m.—11h. 25m. a.m.					1906, 6/iv, 10h. 45m. p.m.—11h. 30m. p.m.				
0	7·15	35·05	27·46	64	0	6·05	35·32	27·79	28	0
10	7·29	35·05	27·43	65	645	6·26	35·32	27·79	32	300
20	7·29	35·05	27·43	65	1300	6·26	35·32	27·79	32	620
30	7·29	35·05	27·43	65	1955	6·24	35·32	27·79	32	940
50	7·30	35·05	27·43	65	3255	6·21	35·32	27·79	32	1580
70	7·30	35·05	27·43	66	4565	6·21	35·32	27·79	32	2320
96	7·31	35·05	27·43	67	6294	—	—	—	—	—
99	—	—	—	—	—	6·22	35·32	27·81	33	3263
—	1906, 12/vi, 3h. 15m. a.m.—4h. 15m. a.m.					1906, 19/vii, 1h. 5m. a.m.—2h. 25m. a.m.				
0	10·35	35·25	27·10	90	0	10·25	35·17	27·06	102	0
10	10·18	35·25	27·12	86	880	10·13	35·19	27·10	97	995
20	7·82	36·25	27·52	57	1595	10·11	35·21	27·12	95	1955
30	7·40	35·25	27·58	52	2140	10·10	35·21	27·12	95	2905
40	—	—	—	—	—	8·91	35·23	27·33	76	3760
50	6·99	35·25	27·63	47	3130	—	—	—	—	—
60	—	—	—	—	—	8·72	35·23	27·36	73	5250
70	6·98	35·25	27·63	47	4070	—	—	—	—	—
80	—	—	—	—	—	8·56	35·23	27·39	73	6710
90	6·97	35·25	27·63	47	5010	—	—	—	—	—
111	6·97	35·25	27·63	48	6007	—	—	—	—	—
112	—	—	—	—	—	8·41	35·23	27·41	71	9014
—	1906, 21/viii, 2h. 25m. p.m.					1906, 20/xi, 3h. 30m. a.m.				
0	11·35	35·09	26·81	127	0	9·65	35·12	27·11	96	0
10	11·21	35·09	26·83	124	1255	9·99	35·12	27·06	100	980
20	11·19	35·09	26·83	124	2495	10·01	35·12	27·06	100	1980
30	11·18	35·11	26·86	121	3720	10·01	35·12	27·06	100	2980
40	10·76	35·11	26·93	114	4895	10·01	35·12	27·06	100	3980
60	10·16	35·11	27·03	105	7085	10·01	35·12	27·06	101	5990
80	9·76	35·11	27·11	100	9135	—	—	—	—	—
87	—	—	—	—	—	10·01	35·12	27·06	102	8730
100	9·73	35·11	27·11	100	11135	—	—	—	—	—

STATION SC. 3.

Latitude, 59° 10′ N. ; Longitude, 1° 27′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 23/i, 3h. 25m. p.m.—4h. 5m. p.m.					1906, 7/iv, 3h. 45m. a.m.—4h. 30m. p.m.				
0	7·25	35·07	27·46	64	0	6·55	35·32	27·75	35	0
10	7·41	35·07	27·44	66	650	6·52	35·32	27·75	34	345
20	7·42	35·07	27·43	66	1310	6·52	35·32	27·75	34	685
30	7·45	35·07	27·43	66	1970	6·52	35·32	27·75	34	1025
40	7·47	35·07	27·43	66	2630	6·52	35·32	27·75	34	1365
60	7·52	35·07	27·42	67	3960	6·53	35·32	27·75	35	2055
84	—	—	—	—	—	6·53	35·32	27·75	35	2895
86	7·54	35·07	27·42	67	5702	—	—	—	—	—

STATION SC. 3—*continued.*

Latitude, 59° 10′ N. ; Longitude, 1° 27′ W.—*continued.*

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 12/vi, 8h. a.m.—9h. a.m.					1906, 25/vii, 8h. 45m. p.m.—9h. 45m. p.m.				
0	8·45	35·26	27·43	67	0	10·05	35·23	27·14	94	0
10	7·80	35·26	27·53	57	620	9·84	35·23	27·18	89	915
20	7·62	35·26	27·56	54	1175	9·59	35·23	27·22	86	1790
30	7·59	35·26	27·56	54	1715	9·46	35·23	27·25	85	2645
40	7·58	35·26	27·56	54	2255	9·43	35·23	27·25	85	3495
60	7·57	35·26	27·56	55	3345	9·18	35·23	27·30	81	5155
80	7·57	35·26	27·56	55	4445	9·16	35·23	27·30	82	6785
102	7·57	35·26	27·56	56	5666	—	—	—	—	—
104	—	—	—	—	—	9·14	35·23	27·30	82	8753
—	1906, 21/viii, 7h. 10m. p.m.					1906, 20/xi, 8h. 30m. a.m.				
0	11·25	35·24	26·93	114	0	9·75	35·12	27·10	97	0
10	11·20	35·24	26·94	113	1135	10·09	35·12	27·04	102	995
20	10·50	35·24	27·08	100	2200	10·09	35·12	27·04	102	2015
30	10·42	35·24	27·09	99	3195	10·09	35·12	27·04	102	3035
40	10·32	35·24	27·10	97	4175	10·09	35·12	27·04	102	4055
60	10·22	35·24	27·12	96	6105	10·09	35·12	27·04	103	6105
84	—	—	—	—	—	10·09	35·12	27·04	104	8589
88	10·23	35·24	27·12	96	8793	—	—	—	—	—

STATION SC. 4.

Latitude, 59° 26′ N. ; Longitude, 1° 20′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 23/i, 6h. p.m.—6h. 45m. p.m.					1906, 7/iv, 6h. 25m. a.m.—7h. 5m. a.m.				
0	7·45	35·30	27·62	50	0	6·25	35·32	27·79	32	0
10	7·56	35·30	27·60	50	500	6·40	35·32	27·77	33	325
20	7·56	35·30	27·60	50	1000	6·40	35·32	27·77	33	655
30	7·56	35·30	27·60	50	1500	6·40	35·32	27·77	33	985
40	7·51	35·30	27·61	50	2000	—	—	—	—	—
50	—	—	—	—	—	6·41	35·32	27·77	34	1655
60	7·47	35·30	27·62	51	3010	—	—	—	—	—
70	—	—	—	—	—	6·41	35·32	27·77	34	2335
89	7·44	35·30	27·62	51	4489	—	—	—	—	—
97	—	—	—	—	—	6·42	35·32	27·77	35	3266
—	1906, 12/vi, 11h. a.m.—1h. 30m. p.m.					1906, 25/vii, 5h. 50m. p.m.—6h. 55m. p.m.				
0	8·85	35·26	27·38	73	0	9·55	35·25	27·24	85	0
10	7·72	35·26	27·54	55	645	9·20	35·25	27·29	78	815
20	6·61	35·26	27·55	54	1190	8·96	35·25	27·34	75	1580
30	6·61	35·26	27·55	54	1730	8·92	35·25	27·35	74	2325
40	—	—	—	—	—	8·90	35·25	27·35	74	3065
50	6·61	35·26	27·55	55	2820	—	—	—	—	—
60	—	—	—	—	—	8·83	35·25	27·36	74	4545
70	6·61	35·26	27·55	55	3920	—	—	—	—	—
80	—	—	—	—	—	8·81	35·25	27·36	74	6025
89	6·61	35·26	27·55	55	4965	—	—	—	—	—
102	—	—	—	—	—	8·81	35·25	27·36	74	7653

STATION Sc. 4—*continued.*

Latitude, 59° 26′ N. ; Longitude, 1° 20′ W.—*continued.*

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 21/viii, 10h. p.m.					1906, 20/xi, 12h. 35m. p.m.				
0	10·55	35·26	27·08	100	0	8·85	35·21	27·31	76	0
10	10·58	35·26	27·08	100	1000	9·08	35·21	27·29	79	775
20	10·58	35·26	27·08	100	2000	9·08	35·21	27·29	79	1565
30	10·51	35·26	27·09	98	2990	9·08	35·21	27·29	79	2355
40	10·43	35·26	27·10	96	3960	—	—	—	—	—
50	—	—	—	—	—	8·82	35·21	27·34	76	3905
60	10·32	35·26	27·11	96	5880	—	—	—	—	—
70	—	—	—	—	—	8·75	35·21	27·35	76	5425
80	10·22	35·26	27·13	95	7790	—	—	—	—	—
96	—	—	—	—	—	8·75	35·21	27·35	76	7401
97	10·11	35·26	27·15	94	9396	—	—	—	—	—

STATION Sc. 5.

Latitude, 59° 40′ N. ; Longitude, 1° 14′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 4/ii, 5h. 55m. p.m.—6h. 45m. p.m.					1906, 7/iv, 9h. 5m. a.m.—9h. 50m. a.m.				
0	6·35	35·30	27·76	35	0	6·05	35·32	27·82	28	0
10	6·71	35·30	27·72	39	370	6·12	35·32	27·81	29	285
20	6·75	35·30	27·71	39	760	6·12	35·32	27·81	29	575
30	6·75	35·30	27·71	39	1150	6·10	35·32	27·81	29	865
40	6·76	35·30	27·71	39	1540	6·10	35·32	27·81	29	1155
60	6·77	35·30	27·71	39	2320	6·11	35·32	27·81	30	1745
80	6·78	35·30	27·71	40	3110	6·11	35·32	27·81	31	2345
103	6·78	35·30	27·71	41	4041	—	—	—	—	—
111	—	—	—	—	—	6·12	35·32	27·81	31	3290
—	1906, 12/vi, 3h. 20m. p.m.—4h. 15m. p.m.					1906, 25/vii, 3h. 10m. p.m.—4h. 10m. p.m.				
0	7·95	35·26	27·52	60	0	9·75	35·26	27·23	87	0
10	7·96	35·26	27·52	60	600	9·41	35·26	27·28	81	840
20	7·91	35·26	27·53	58	1190	9·24	35·26	27·31	77	1630
30	7·80	35·26	27·55	57	1765	9·21	35·26	27·31	77	2400
40	7·76	35·26	27·55	57	2335	9·19	35·26	27·32	77	3170
60	7·76	35·26	27·55	58	3485	9·16	35·26	27·32	77	4710
80	7·76	35·26	27·55	58	4645	9·03	35·26	27·35	77	6250
99	—	—	—	—	—	8·65	35·26	27·40	72	7665
101	7·77	35·26	27·55	59	5873	—	—	—	—	—
—	1906, 22/viii, 1h. 35m. a.m.					1906, 20/xi, 3h. 50m. p.m.				
0	11·05	35·27	27·00	106	0	8·75	35·25	27·37	72	0
10	11·12	35·27	26·99	108	1070	8·96	35·25	27·33	75	735
20	10·81	35·27	27·05	103	2125	8·96	35·25	27·33	75	1485
30	10·39	35·27	27·12	96	3120	8·96	35·25	27·33	75	2235
40	10·20	35·27	27·15	92	4060	8·96	35·25	27·33	75	2985
60	10·12	35·27	27·19	92	5900	8·96	35·25	27·33	76	4495
80	10·00	35·27	27·19	90	7720	8·96	35·25	27·33	77	6025
100	—	—	—	—	—	8·97	35·25	27·33	78	7575
103	9·12	35·27	27·34	76	9629	—	—	—	—	—

Station Sc. 5*a*.

Latitude, 60° 05′ N. ; Longitude, 0° 48′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 7/iv, 4h. 10m. p.m.—5h. 50m. p.m.					1906, 13/vi, 2h. 30m. p.m.—3h. 25m. p.m.				
0	6·35	35·32	27·78	33	0	9·15	35.26	27·33	77	0
10	6·48	35·32	27·76	34	335	9·02	35·26	27·35	75	760
20	6·48	35·32	27·76	34	675	8·85	35·26	27·38	73	1500
30	6·45	35·32	27·76	34	1015	7·80	35·26	27·54	57	2150
50	6·39	35·32	27·77	34	1695	7·39	35·26	27·59	52	3240
70	6·32	35·32	27·78	34	2375	7·39	35·26	27·59	52	4280
90	6·33	35·32	27·78	35	3065	7·40	35·26	27·59	53	5330
113	6·33	35·32	27·78	35	3870	—	—	—	—	—
114	—	—	—	—	—	7·40	35·26	27·59	53	6602
—	1906, 23/vii, 8h. 30m. a.m.—9h. 15m. a.m.					1906, 22/viii, 9h. 35m. a.m.				
0	10·05	35·26	27·17	92	0	11·55	35·27	26·92	117	0
10	10·04	35·26	27·17	92	920	11·52	35·27	26·92	117	1170
20	9·99	35·26	27·18	90	1830	11·18	35·27	26·97	110	2305
30	9·95	35·26	27·19	90	2730	10·50	35·27	27·10	97	3340
40	9·94	35·26	27·19	90	3630	10·12	35·27	27·17	91	4280
50	—	—	—	—	—	9·52	35·27	27·28	82	5145
60	8·92	35·26	27·36	74	5270	—	—	—	—	—
70	—	—	—	—	—	9·03	35·27	27·35	74	6705
80	8·09	35·26	27·49	63	6640	—	—	—	—	—
90	—	—	—	—	—	8·81	35·27	27·40	72	8165
101	8·09	35·26	27·49	63	7963	—	—	—	—	—
110	—	—	—	—	—	8·81	35·27	27·40	72	9605
—	1906, 21/xi, 12h. 50m. a.m.					—				
0	9·05	35·26	27·34	76	0	—	—	—	—	—
10	9·42	35·26	27·29	81	785	—	—	—	—	—
20	9·42	35·26	27·29	81	1595	—	—	—	—	—
30	9·42	35·26	27·29	81	2405	—	—	—	—	—
40	9·42	35·26	27·29	81	3215	—	—	—	—	—
60	9·42	35·26	27·29	82	4845	—	—	—	—	—
80	9·42	35·26	27·29	83	6495	—	—	—	—	—
104	9·45	35·26	27·29	85	8511	—	—	—	—	—

Station Sc. 5*b*.

Latitude, 60° 05′ N.; Longitude, 0° 48′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 10/iv, 11h. 10m. a.m.—11h. 55m. a.m.					1906, 13/vi, 6h. 45m. p.m —7h. 45m. p.m.				
0	7·25	35·32	27·66	45	0	8·85	35·26	27·36	73	0
10	6·91	35·32	27·70	39	420	8·73	35·26	27·38	71	720
20	6·88	35·32	27·70	39	810	7·95	35·26	27·51	60	1375
30	6·82	35·32	27·71	38	1195	7·82	35·26	27·53	57	1960
40	6·76	35·32	27·72	38	1575	7·75	35·26	27·54	57	2530
60	6·72	35·32	27·72	38	2335	7·75	35·26	27·54	58	3680
80	6·72	35·32	27·72	38	3095	7·74	35·26	27·54	58	4840
100	6·66	35·32	27·73	38	3855	7·66	35·26	27·55	57	5990
134	6·66	35·32	27·73	38	5147	—	—	—	—	—
154	—	—	—	—	—	7·49	35·26	27·58	56	9041

STATION Sc. 5*b*—*continued*.

Latitude, 60° 31′ N.; Longitude, 0° 35′ W. | Latitude, 60° 34′ N.; Longitude 0° 29′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 23/vii, 12h. 15m. p.m.—1h. 20m. p.m.					1906, 22/viii, 1h. 55 p.m.				
0	10·75	35·26	27·05	104	0	10·85	35·29	27·05	103	0
10	10·41	35·26	27·11	97	1005	10·80	35·29	27·06	102	1025
20	10·32	35·26	27·12	95	1965	10·80	35·29	27·06	102	2045
30	10·11	35·26	27·16	92	2900	10·80	35·29	27·06	102	3065
40	9·98	35·26	27·18	90	3810	10·61	35·29	27·09	98	4065
60	9·85	35·26	27·21	89	5600	10·20	35·29	27·16	92	5965
80	9·39	35·26	27·28	83	7320	9·67	35·29	27·25	85	7735
100	9·15	35·26	27·33	79	8940	9·40	35·29	27·29	80	9385
140	—	—	—	—	—	9·17	35·29	27·34	77	12525
148	8·56	35·26	27·42	71	12540	—	—	—	—	—

Latitude, 60° 31′ N.; Longitude, 0° 35′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 21/xi, 5h. 25m. a.m.					——				
0	9·45	35·26	27·28	81	0	—	—	—	—	—
10	9·52	35·26	27·27	82	815	—	—	—	—	—
20	9·55	35·26	27·27	82	1635	—	—	—	—	—
30	9·55	35·26	27·27	82	2455	—	—	—	—	—
40	9·55	35·26	27·27	82	3275	—	—	—	—	—
60	9·52	35·26	27·27	83	4925	—	—	—	—	—
80	9·52	35·26	27·27	84	6595	—	—	—	—	—
100	9·53	35·26	27·27	85	8285	—	—	—	—	—
150	9·53	35·26	27·27	86	12560	—	—	—	—	—

STATION Sc. 6.

Latitude, 60° 37′ N.; Longitude, 0° 29′ E.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 13/iv, 1h. 35m. p.m.—2h. 20m. p.m.					1906, 26/vii, 1h. 10m. p.m—2h. 5m. p.m.				
0	7·35	35·32	27·64	47	0	11·25	35·28	26·96	109	0
10	7·24	35·32	27·66	45	460	11·01	35·28	27·01	105	1070
20	7·15	35·32	27·67	44	905	10·23	35·28	27·14	91	2050
30	6·85	35·32	27·71	40	1325	10·16	35·28	27·16	91	2960
40	—	—	—	—	—	10·15	35·28	27·16	91	3870
50	6·73	35·32	27·73	39	2115	8·02	35·28	27·52	59	4620
60	—	—	—	—	—	7·72	35·28	27·56	54	5185
70	6·70	35·32	27·72	39	2895	—	—	—	—	—
80	—	—	—	—	—	7·52	35·28	27·59	53	6255
90	6·70	35·32	27·73	40	3685	—	—	—	—	—
100	—	—	—	—	—	7·52	35·28	27·59	53	7315
136	6·70	35·32	27·73	40	5125	—	—	—	—	—
138	—	—	—	—	-	7·52	35·28	27·59	53	9329

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 5/ix, 4h. a.m.					——				
0	12·05	35·18	26·74	132	0	—	—	—	—	—
10	12·12	35·20	26·74	131	1315	—	—	—	—	—
20	12·12	35·22	26·76	129	2615	—	—	—	—	—
30	11·72	35·24	26·84	121	3865	—	—	—	—	—
40	10·18	35·24	27·12	95	4945	—	—	—	—	—
60	7·78	35·27	27·54	57	6465	—	—	—	—	—
80	7·02	35·27	27·66	47	7505	—	—	—	—	—
130	6·63	35·27	27·71	43	9755	—	—	—	—	—

Station Sc. 6*a*.

Latitude, 60° 05′ N. ; Longitude, 0° 33′ E.

Depth (Metres).	Temp. °C.	S.°/oo	σt.	v—v′	e—e′	Temp. °C.	S.°/oo	σt.	v—v′	e—e′
—	1906, 13/iv, 5h. 55m. p.m.—6h. 35m. p.m.					1906, 5/ix, 10h. a.m.				
0	6·85	35·32	27·71	39	0	12·55	35·20	26·65	139	0
10	6·86	35·32	27·71	39	390	12·50	35·20	26·66	138	1385
20	6·71	35·32	27·73	38	775	11·98	35·22	26·78	127	2710
30	—	—	—	—	—	11·80	35·24	26·83	123	3960
40	6·46	35·32	27·76	35	1505	9·97	35·24	27·16	92	5035
60	6·30	35·32	27·78	35	2205	7·13	35·26	27·62	48	6435
80	6·31	35·32	27·78	35	2905	6·32	35·27	27·75	38	7295
100	6·31	35·32	27·78	36	3615	—	—	—	—	—
125	—	—	—	—	—	6·29	35·27	27·75	39	8257
162	6·32	35·32	27·28	37	5878	—	—	—	—	—

Station Sc. 7.

Latitude, 61° 06′ N. ; Longitude, 2° 01′ E.

Depth (Metres).	Temp. °C.	S.°/oo	σt.	v—v′	e—e′	Temp. °C.	S.°/oo	σt.	v—v′	e—e′
—	1906, 13/iv, 12h. 35m. a.m.—1h. 20m. a.m.					1906, 4/ix, 10h. 33m. a.m.				
0	6·65	35·32	27·73	37	0	12·25	35·15	26·67	139	0
10	6·84	35·32	27·71	39	380	12·10	35·17	26·71	132	1355
20	6·84	35·32	27·71	39	770	11·88	35·20	26·78	127	2650
30	6·71	35·32	27·72	37	1150	11·52	35·22	26·88	118	3875
40	—	—	—	—	—	10·59	35·22	27·05	102	4975
50	6·72	35·32	27·72	38	1900	—	—	—	—	—
60	—	—	—	—	—	8·76	35·27	27·40	71	6705
70	6·61	35·32	27·74	36	2640	—	—	—	—	—
80	—	—	—	—	—	8·29	35·27	27·46	65	8065
90	6·62	35·32	27·74	37	3370	—	—	—	—	—
100	—	—	—	—	—	7·85	35·27	27·54	58	9295
130	—	—	—	—	—	7·14	35·27	27·64	48	10885
150	6·58	35·32	27·74	38	5620	—	—	—	—	—

Station Sc, 7*a*.

Latitude, 60° 45′ N. ; Longitude, 2° 30′ E.

Depth (Metres).	Temp. °C.	S.°/oo	σt.	v—v′	e—e′	Temp. °C.	S.°/oo	σt.	v—v′	e—e′
—	1906, 13/iv, 4h. 15m. a.m.—5h. a.m.					1906, 26/vii, 10h. 55m. p.m.—12h. p.m.				
0	6·75	35·32	27·72	38	0	11·05	34·99	26·78	127	0
10	6·68	35·32	27·73	37	375	10·61	34·99	26·86	120	1235
20	6·68	35·32	27·73	37	745	10·29	34·99	26·92	115	2410
30	6·62	35·32	27·74	37	1115	7·40	35·28	27·60	50	3235
50	6·51	35·32	27·75	36	1845	—	—	—	—	—
70	6·43	35·32	27·76	36	2565	7·10	35·28	27·65	46	5155
90	6·43	35·32	27·76	36	3285	6·72	35·28	27·70	42	6035
115	—	—	—	—	—	6·71	35·28	27·70	42	7085
129	6·44	35·32	27·76	36	4689	—	—	—	—	—
—	1909, 4/ix, 4h. 10m. p.m.					——				
0	12·35	35·09	26·61	145	0	—	—	—	—	—
10	12·40	35·13	26·63	142	1435	—	—	—	—	—
20	11·75	35·20	26·82	126	2775	—	—	—	—	—
30	10·32	35·22	27·09	98	3895	—	—	—	—	—
40	9·49	35·26	27·26	82	4795	—	—	—	—	—
60	8·82	35·26	27·37	72	6335	—	—	—	—	—
80	8·43	35·26	27·43	67	7725	—	—	—	—	—
120	7·49	35·26	27·57	56	10185	—	—	—	—	—

Station Sc. 7*b*.

Latitude, 60° 35′ N. ; Longitude, 1° 50′ E.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 13/iv, 7h. 55m. a.m.—8h. 30m. a.m.					1906. 26/vii, 7h. 20m. p.m.—8h. 25m. p.m.				
0	6·65	35·32	27·74	37	0	11·65	35·21	26·84	123	0
10	6·72	35·32	27·73	37	370	11·15	35·21	26·93	113	1180
20	6·72	35·32	27·73	37	740	10·55	35·21	27·04	103	2260
30	6·41	35·32	27·76	34	1095	10·31	35·23	27·10	98	3265
40	—	—	—	—	—	9·22	35·26	27·31	77	4140
50	6·29	35·32	27·78	33	1765	7·42	35·28	27·60	51	4780
60	—	—	—	—	—	7·32	35·28	27·61	49	5280
70	6·29	35·32	27·78	33	2425	—	—	—	—	—
80	—	—	—	—	—	7·01	35·28	27·66	46	6230
90	6·22	35·32	27·79	34	3095	—	—	—	—	—
100	—	—	—	—	—	6·92	35·28	27·67	45	7140
129	—	—	—	—	—	6·91	35·28	27·67	45	8445
146	6·23	35·32	27·79	35	5027	—	—	—	—	—

—	1906, 4/ix, 9h. p.m.					———				
0	12·55	35·08	26·54	148	0	—	—	—	—	—
10	12·64	35·08	26·52	150	1190	—	—	—	—	—
20	12·15	35·08	26·63	142	2950	—	—	—	—	—
30	11·80	35·09	26·71	134	4330	—	—	—	—	—
40	7·80	35·26	27·53	57	5285	—	—	—	—	—
60	7·28	35·29	27·63	49	6345	—	—	—	—	—
80	6·69	35·29	27·72	42	7255	—	—	—	—	—
120	6·67	35·29	27·72	42	8935	—	—	—	—	—

Station Sc. 7*c*.

Latitude, 60° 34′ N. ; Longitude, 1° 15′ E.

—	1906, 13/iv, 10h. 40m. a.m.—11h. 30m. a.m.					1906, 26/vii, 4h. 20m. p.m.—5h. 20m. p.m.				
0	7·05	35·32	27·69	42	0	11·15	35·23	26·94	112	0
10	7·00	35·32	27·69	41	415	10·94	35·23	26·98	108	1100
20	6·95	35·32	27·70	41	825	10·24	35·23	27·10	96	2120
30	—	—	—	—	—	8·40	35·26	27·44	65	2925
40	6·69	35·32	27·73	38	1615	7·69	35·26	27·55	55	3525
60	6·60	35·32	27·74	38	2375	6·99	35·28	27·66	45	4525
80	6·60	35·32	27·74	38	3135	6·87	35·28	27·67	45	5425
100	6·61	35·32	27·74	39	3905	6·70	35·28	27·69	43	6305
136	—	—	—	—	—	6·64	35·28	27·70	43	7853
154	6·62	35·32	27·74	40	6038	—	—	—	—	—

—	1906, 5/ix, 0h. 25m. a.m.					———				
0	12·45	35·15	26·63	142	0	—	—	—	—	—
10	12·38	35·15	26·64	140	1410	—	—	—	—	—
20	11·98	35·17	26·73	127	2745	—	—	—	—	—
30	10·50	35·23	27·06	101	3885	—	—	—	—	—
40	8·62	35·29	27·43	66	4720	—	—	—	—	—
60	7·84	35·29	27·55	56	5940	—	—	—	—	—
80	7·65	35·29	27·57	54	7040	—	—	—	—	—
120	6·76	35·29	27·71	44	9000	—	—	—	—	—

Station Sc. 8.

Latitude, 61° 30′ N. ; Longitude, 3° 03′ E.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 12/iv, 6h. 45m. p.m.—8h. p.m.					1906, 4/ix, 2h. 20m. a.m.				
0	5·25	34·18	27·02	106	0	12·35	31·35	23·71	418	0
10	5·30	34·22	27·02	103	1045	12·22	32·92	24·95	298	3580
20	5·50	34·22	27·01	105	2085	11·38	34·31	26·19	184	5990
30	—	—	—	—	—	9·42	34·93	27·01	105	7435
40	5·89	34·49	27·18	88	4015	9·41	35·13	27·17	90	8410
60	6·16	34·78	27·38	73	5625	8·62	35·26	27·40	69	10000
80	6·63	34·92	27·43	68	7035	8·53	35·26	27·42	69	11380
100	6·96	35·01	27·45	66	8327	8·34	35·26	27·44	67	12740
150	7·13	35·19	27·57	55	11400	7·74	35·22	27·52	62	15965
200	—	—	—	—	—	7·44	—	—	—	—
250	7·07	35·19	27·58	56	16950	7·06	35·20	27·59	56	21865
350	—	—	—	—	—	5·95	35·15	27·70	47	27015
379	6·91	35·19	27·60	56	24174	—	—	—	—	—

Station Sc. 9.

Latitude, 61° 34′ N. ; Longitude, 2° 04′ E.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 12/iv, 1h. 25m. p.m.—3h. p.m.					1906, 3/ix, 7h. 25m. p.m.				
0	7·05	35·19	27·59	51	0	11·65	34·73	26·47	158	0
10	7·00	35·19	27·59	51	510	11·49	34·75	26·51	154	1560
20	7·00	35·19	27·59	51	1020	11·00	35·15	26·91	115	2905
30	7·00	35·19	27·59	51	1530	10·91	35·17	26·94	112	4040
40	7·00	35·19	27·59	51	2040	10·41	35·20	27·06	101	5105
60	7·00	—	—	52	3070	9·25	35·33	27·35	75	6865
80	7·02	35·19	27·59	52	4110	9·10	35·33	27·37	72	8335
100	7·04	35·19	27·59	53	5160	8·96	35·33	27·39	72	9775
150	6·80	35·19	27·62	51	7760	8·63	35·31	27·45	68	13275
200	6·80	35·19	27·62	52	10335	8·41	35·29	27·46	68	16675
250	6·76	35·19	27·62	52	12935	8·08	35·27	27·50	66	20025
350	—	—	—	—	—	8·09	35·27	27·50	68	26725
395	6·48	35·19	27·66	51	20402	—	—	—	—	—

Station Sc. 10.

Latitude, 61° 35′ N. ; Longitude, 0° 47′ E.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 12/iv, 8h. 5m. a.m.—9h. 10m. a.m.					1906, 3/ix, 12h. 40m. p.m.				
0	7·45	35·28	27·60	51	0	11·85	35·26	26·82	123	0
10	—	—	—	—	—	11·78	35·26	26·84	121	1220
20	7·51	35·28	27·59	51	510	11·36	35·26	26·93	114	2395
30	7·51	35·28	27·59	51	1020	11·22	35·26	26·95	111	3520
40	7·50	35·28	27·59	51	1530	11·11	35·29	27·00	107	4610
60	7·50	35·28	27·59	52	2560	9·39	35·31	27·31	78	6460
80	7·43	35·28	27·60	52	3600	8·92	35·33	27·40	70	7940
100	7·31	35·28	27·61	50	4620	8·74	35·33	27·43	68	9320
150	7·25	35·28	27·62	50	7100	8·34	35·33	27·50	63	12595
204	—	—	—	—	—	8·02	35·33	27·55	60	15916
221	6·86	35·26	27·67	48	10579	—	—	—	—	—

Station Sc. 11.

Latitude 61′ 38° N.; Longitude, 0° 41′ W.

Depth (Metres).	Temp. °C.	S.‰	σt.	v—v′	e—e′	Temp. °C.	S.‰	σt.	v—v′	e—e′
—	1906, 12/iv, 2h. 15m. a.m.—3h. 30m. a.m.					1906, 2/ix, 6h. 30m. a.m.				
0	7·65	35·30	27·59	52	0	11·05	35·26	26·98	107	0
10	7·80	35·30	27·57	54	530	11·02	35·26	26·99	105	1060
20	7·80	35·30	27·57	54	1070	11·00	35·26	26·99	105	2110
30	7·80	35·30	27·57	54	1610	10·68	35·27	27·07	101	3140
40	7·79	35·30	27·57	54	2150	10·38	35·31	27·15	93	4110
60	7·76	35·30	27·58	54	3230	9·62	35·31	27·28	81	5850
80	7·74	35·30	27·58	54	4310	9·31	35·33	27·34	76	7420
100	7·74	35·30	27·58	55	5400	9·21	35·33	27·36	75	8930
150	7·52	35·30	27·61	53	8100	8·94	35·33	27·40	72	12605
200	7·43	35·30	27·62	52	10725	8·66	35·33	27·45	70	16155
251	7·13	35·30	27·66	49	13300	—	—	—	—	—
280	—	—	—	—	—	8·54	35·33	27·48	66	21595

Station Sc. 12.

Latitude, 61° 02′ N.; Longitude, 1° 10′ W.

Depth (Metres).	Temp. °C.	S.‰	σt.	v—v′	e—e′	Temp. °C.	S.‰	σt.	v—v′	e—e′
—	1906, 11/iv, 11h. 15m. a.m.—noon.					1906, 14/vi, 5h. 40m. p.m.—6h. 30m. p.m.				
0	7·05	35·32	27·68	42	0	9·55	35·26	27·26	84	0
10	7·79	35·32	27·59	52	470	9·45	35·26	27·27	82	830
20	7·75	35·32	27·59	52	990	9·00	35·26	27·35	74	1610
30	7·75	35·32	27·59	52	1510	8·32	35·26	27·46	64	2300
40	7·75	35·32	27·59	52	2030	8·21	35·26	27·48	62	2930
60	7·73	35·32	27·59	53	3080	8·04	35·26	27·51	61	4160
80	7·68	35·32	27·60	52	4130	7·82	35·26	27·54	58	5350
100	7·05	35·32	27·68	44	5090	7·64	35·26	27·57	56	6490
132	—	—	—	—	—	7·62	35·26	27·57	56	8282
133	6·90	35·32	27·70	42	6509	—	—	—	—	—
—	1906, 1/ix, 3h. 30m. p.m.					—				
0	11·75	35·33	26·90	116	0	—	—	—	—	—
10	11·58	35·33	26·95	113	1145	—	—	—	—	—
20	11·54	35·33	26·95	111	2265	—	—	—	—	—
30	11·50	35·33	26·96	111	3375	—	—	—	—	—
40	11·41	35·33	26·98	109	4475	—	—	—	—	—
60	9·89	35·33	27·25	84	6405	—	—	—	—	—
80	9·16	35·33	27·37	72	7965	—	—	—	—	—
100	8·81	35·33	27·43	66	9345	—	—	—	—	—
130	8·80	35·33	27·43	66	11325	—	—	—	—	—

Station Sc. 13*a*.

Latitude, 61° 16′ N.; Longitude, 2° 08′ W.

Depth (Metres).	Temp. °C.	S.‰	σt.	v—v′	e—e′	Temp. °C.	S.‰	σt.	v—v′	e—e′
—	1906, 14/vi, 10h. 15m. p.m.—1h. 45m. a.m.					1906, 24/viii, 3h. 55m. p.m.				
0	8·85	35·26	27·37	73	0	11·55	35·33	26·94	113	0
10	8·60	35·26	27·41	68	705	11·45	35·33	26·97	111	1120
20	8·49	35·26	27·43	66	1375	11·43	35·33	26·97	110	2225
30	8·41	35·26	27·44	65	2030	11·22	35·33	27·01	106	3305
40	8·38	35·26	27·44	65	2680	11·10	35·33	27·03	105	4360
60	8·27	35·26	27·45	65	3980	9·76	35·33	27·26	83	6240
80	7·94	35·26	27·51	59	5220	9·33	35·33	27·33	76	7830
100	7·78	35·26	27·54	59	6400	9·24	35·33	27·35	77	9360
150	7·22	35·21	27·58	55	9250	—	—	—	—	—
200	6·90	35·17	27·59	55	12000	9·03	35·33	27·39	74	16910
250	6·56	35·16	27·63	52	14675	—	—	—	—	—
300	6·12	35·16	27·68	47	17150	8·70	35·31	27·45	74	24310
350	5·65	35·10	27·70	46	19475	—	—	—	—	—
400	4·45	35·03	27·78	37	21650	8·15	35·27	27·50	70	31510
450	3·89	34·97	27·80	36	23375	—	—	—	—	—
500	2·54	34·94	27·91	25	24900	7·06	35·24	27·62	57	37860
550	1·69	34·92	27·95	18	25975	—	—	—	—	—
600	1·15	34·92	27·99	14	26775	5·63	35·11	27·70	50	43210
650	—	34·92	—	—	—	—	—	—	—	—

Station Sc. 14*a*.

Latitude, 61° 18′ N. ; Longitude, 3° 00′ W.

Depth (Metres).	Temp. °C.	S.°/oo	σt.	v—v′	e—e′	Temp. °C.	S.°/oo	σt.	v—v′	e—e′
—	1906, 15/vi, 4h. 30m. a.m.—8h. 45m. a.m.					1906, 24/viii, 7h. 55m. p.m.				
0	8·75	35·26	27·38	71	0	11·25	35·33	27·00	107	0
10	8·70	35·26	27·38	70	705	11·26	35·33	27·00	107	1070
20	8·38	35·26	27·44	65	1380	11·30	35·33	27·00	107	2140
30	7·80	35·26	27·54	57	1990	11·24	35·33	27·00	107	3210
40	7·38	35·23	27·57	56	2555	10·83	35·33	27·08	98	4235
60	7·18	35·21	27·58	53	3645	9·62	35·33	27·29	79	6005
80	6·89	35·19	27.60	51	4685	9·28	35·33	27·34	75	7545
100	6·79	35·19	27·61	50	5695	9·17	35·33	27·36	74	9035
150	6·65	35·17	27·62	50	8195	—	—	—	—	—
200	6·14	35·16	27·67	46	10595	8·43	35·29	27·46	68	16135
250	5·79	35·12	27·69	44	12845	—	—	—	—	—
300	4·58	35·05	27·78	37	14870	7·85	35·27	27·53	64	22735
350	3·55	34·99	27·85	30	16545	—	—	—	—	—
400	2·54	34·94	27·91	25	17920	7·29	35·24	27·59	59	28885
450	1·02	34·92	28·00	14	18895	—	—	—	—	—
500	0·30	34·92	28·04	7	19420	*4·36	35·09	27·84	35	33585
550	—0·09	34·92	28·06	6	19745	—	—	—	—	—
600	—0·26	34·92	28·07	5	20020	*2·81	35·08	28·00	19	36285
700	—	—	—	—	—	*3·38	35·08	27·93	25	38485
800	—0·57	34·92	28·09	2	20720	*2·54	35·06	28·00	20	40735
900	—	—	—	—	—	*2·73	35·06	27·98	22	42835
1000	—0·75	34·92	28·10	—1	20820	*3·02	35·06	27·95	25	45185
1100	—	—	—	—	—	*2·43	35·06	28·01	21	47485
1180	—0·91	34·92	28·10	—2	20550	—	—	—	—	—

* Observations from 500 metres downwards are irregular and probably erroneous, due to bad closing of the water-bottle. (Compare the observations from Station 11a, where the bottom layers consisted of the usual cold water from 600 metres downwards.)

Station Sc. 15*a*.

Latitude, 61° 27′ N. ; Longitude, 3° 42′ W.

Depth (Metres).	Temp. °C.	S.°/oo	σt.	v—v′	e—e′	Temp. °C.	S.°/oo	σt.	v—v′	e—e′
—	1906, 15/vi, 11h. 15m. a.m.—4h. 35m. p.m.					1906, 25/viii, 3h. 35m. a.m.				
0	8·55	35·19	27·36	74	0	9·65	35·18	27·17	91	0
10	8·44	35·17	27·36	72	730	9·95	35·18	27·13	94	925
20	7·45	35·14	27·48	57	1375	9·93	35·18	27·13	94	1865
30	6·45	35·10	27·60	50	1910	9·47	35·18	27·21	88	2775
40	6·45	35·10	27·60	50	2410	9·02	35·17	27·29	81	3620
60	5·44	35·08	27·71	40	3310	7·82	35·15	27·45	66	5090
80	4·69	35·07	27·78	34	4050	7·51	35·15	27·49	62	6370
100	4·47	35·05	27·79	34	4730	7·42	35·13	27·49	64	7630
150	3·55	34·99	27·85	30	6330	—	—	—	—	—
200	2·23	34·96	27·94	21	7605	7·14	35·13	27·52	62	13930
250	1·76	34·92	27·95	19	8605	—	—	—	—	—
300	1·43	34·92	27·97	15	9455	2·81	34·96	27·90	25	18280
350	0·83	34·92	28·01	11	10105	—	—	—	—	—
400	0·34	34·92	28·04	7	10645	0·72	34·92	28·02	10	20030
450	0·10	34·92	28·06	7	10995	—	—	—	—	—
500	—0·07	34·92	28·07	6	11320	+0·41	34·92	28·04	9	20980
550	—0·20	34·92	28·07	6	11620	—	—	—	—	—
600	—0·35	34·92	28·08	5	11895	—0·08	34·92	28·06	6	21730
700	—0·49	34·92	28·08	4	12345	—0·34	34·92	28·08	3	22180
800	—0·60	34·92	28·09	3	12695	—0·49	34·92	28·08	2	22430
900	—0·67	34·92	28·09	3	12995	—0·59	34·92	28·09	2	22630
1000	—	—	—	—	—	—0·71	34·92	28·09	1	22780
1100	—0·86	34·92	28·10	0	13295	—0·76	34·92	28·10	1	22880
1250	—0·92	34·92	28·10	0	13295	—	—	—	—	—

STATION SC. 15*b*.

Latitude, 61° 39′ N.; Longitude, 4° 45′ W. — Latitude, 61° 45′ N.; Longitude, 5° 05′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 15/vi, 10h. p.m.—1h. 10m. a.m.					1906, 25/viii, 11h. 40m. a.m.				
0	8·75	35·26	27·38	71	0	9·75	35·18	27·16	93	0
10	8·52	35·26	27·41	67	690	9·72	35·18	27·17	92	925
20	7·92	35·26	27·52	58	1315	9·62	35·18	27·19	90	1835
30	7·20	35·23	27·59	51	1860	9·62	35·18	27·19	90	2735
40	7·01	35·21	27·61	49	2360	9·62	35·18	27·19	90	3635
60	6·92	35·21	27·62	49	3340	9·62	35·18	27·19	91	5445
80	6·83	35·19	27·62	49	4320	7·91	35·17	27·44	67	7025
100	6·80	35·19	27·62	50	5310	7·63	35·17	27·48	62	8315
150	6·78	35·19	27·62	50	7810	7·44	35·17	27·51	62	11415
200	6·74	35·19	27·63	50	10310	—	—	—	—	—
230	—	—	—	—	—	7·43	35·17	27·51	63	16415
250	6·54	35·19	27·66	50	12810	—	—	—	—	—
300	6·16	35·16	27·67	48	15260	—	—	—	—	—
350	5·48	35·10	27·72	44	17560	—	—	—	—	—
500	1·97	34·92	27·93	20	22360	—	—	—	—	—
600	0·62	34·92	28·02	11	23910	—	—	—	—	—
700	−0·40	34·92	28·07	3	24610	—	—	—	—	—

STATION SC. 16*a*.

Latitude, 61° 49′ N.; Longitude, 5° 36′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 16/vi, 4h. 40m. a.m.—5h. 45m. a.m.					1906, 25/viii, 4h. p.m.				
0	8·75	35·21	27·35	75	0	9·65	35·18	27·18	91	0
10	8·82	35·21	27·35	75	750	9·62	35·18	27·18	90	905
20	8·52	35·21	27·39	70	1475	9·48	35·18	27·21	88	1795
30	8·40	35·21	27·40	69	2170	9·40	35·18	27·22	87	2670
40	7·91	35·21	27·49	63	2830	9·35	35·18	27·23	86	3535
60	7·10	35·19	27·58	52	3980	7·92	35·17	27·44	68	5075
80	6·97	35·19	27·60	52	5020	7·60	35·17	27·49	64	6395
100	6·84	35·19	27·62	52	6060	7·59	35·17	27·49	64	7675
150	6·32	35·19	27·67	45	8585	7·50	35·17	27·50	63	10850
200	6·13	35·19	27·70	44	10810	—	—	—	—	—

STATION SC. 16.

Latitude, 62° 00′ N.; Longitude, 6° 12′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 16/vi, 8h. 10m. a.m—9h. 5m. a.m.					1906, 25/viii, 8h. 10m. p.m.				
0	8·45	35·19	27·37	72	0	8·95	35·17	27·27	81	0
10	8·06	35·19	27·43	66	690	8·95	35·17	27·27	81	810
20	7·93	35·19	27·47	64	1340	8·90	35·17	27·28	80	1615
30	7·71	35·19	27·49	61	1965	8·89	35·17	27·28	80	2415
40	7·46	35·19	27·52	57	2555	8·85	35·17	27·29	79	2210
60	6·76	35·19	27·62	48	3605	8·72	35·17	27·31	77	4770
80	6·63	35·19	27·64	48	4565	8·69	35·17	27·31	78	6320
100	6·60	35·19	27·64	48	5525	—	—	—	—	—
120	—	—	—	—	—	8·64	35·17	27·32	78	9440
150	6·59	35·19	27·65	49	7950	—	—	—	—	—
180	6·55	35·19	27·65	48	9405	—	—	—	—	—

Station Sc. 17.

Latitude, 61° 11′ N. ; Longitude, 6° 33′ W.

Depth (Metres).	Temp. °C.	S.‰	σt.	v—v′	e—e′	Temp. °C.	S.‰	σt.	v—v′	e—e′
—	1906, 18/vi, 11h. 45m. a.m.—12h. 40m. p.m.					1906, 27/viii, 8h. 5m. p.m.				
0	7·55	35·29	27·53	56	0	9·85	35·18	27·15	95	0
10	7·07	35·19	27·58	52	540	9·91	35·18	27·14	96	955
20	6·93	35·19	27·60	50	1050	9·62	35·18	27·19	90	1885
30	6·91	35·19	27·60	50	1550	9·20	35·18	27·25	83	2750
40	6·92	35·19	27·60	51	2055	8·66	35·18	27·34	76	3545
60	6·92	35·19	27·60	51	3075	8·16	35·18	27·42	69	4995
80	6·93	35·19	27·60	51	4095	7·81	35·17	27·46	65	6335
100	6·93	35·19	27·60	52	5125	7·66	35·17	27·48	64	7625
140	6·94	35·19	27·60	52	7205	7·60	35·17	27·49	64	10185

Station Sc. 18*a*.

Latitude, 60° 57′ N. ; Longitude, 5° 47′ W.

Depth (Metres).	Temp. °C.	S.‰	σt.	v—v′	e—e′	Temp. °C.	S.‰	σt.	v—v′	e—e′
—	1906, 18/vi, 3h. 35m. p.m.—6h. 15m. p.m.					1906, 28/viii, 1h. a.m.				
0	10·05	35·30	27·20	89	0	10·15	35·18	27·11	100	0
10	9·61	35·30	27·27	81	850	10·11	35·18	27·10	99	995
20	8·66	35·28	27·41	68	1595	10·10	35·18	27·10	99	1985
30	8·10	35·26	27·49	61	2240	10·01	35·18	27·12	97	2965
40	7·61	35·26	27·57	54	2815	9·92	35·18	27·14	96	3930
60	7·44	35·26	27·59	52	3875	9·68	35·18	27·17	93	5820
80	7·08	35·25	27·62	48	4875	8·63	35·18	27·36	78	7530
100	6·92	35·23	27·63	48	5835	7·89	35·18	27·46	68	8990
150	6·77	35·23	27·65	47	8210	7·50	35·18	27·52	66	12340
200	6·72	35·21	27·65	48	10585	7·01	35·18	27·59	56	15390
250	6·34	35·19	27·68	46	12935	6·42	35·13	27·63	52	18090
300	6·04	35·16	27·70	45	15210	5·22	35·09	27·75	42	20440
340	—	—	—	—	—	4·24	35·08	27·84	30	21880
355	3·58	34·99	27·84	31	17300	—	—	—	—	—

Station Sc. 19*a*.

Latitude, 60° 40′ N. ; Longitude, 4° 50′ W.

Depth (Metres).	Temp. °C.	S.‰	σt.	v—v′	e—e′	Temp. °C.	S.‰	σt.	v—v′	e—e′
—	1906, 18/vi, 10h. p.m.—1h. 55m. a.m.					1906, 28/viii, 6h. 55m. a.m.				
0	10·05	35·30	27·20	87	0	10·75	35·18	26·99	110	0
10	9·60	35·30	27·27	81	840	10·74	35·18	26·99	110	1100
20	8·90	35·28	27·38	71	1600	10·43	35·18	27·05	103	2165
30	8·45	35·26	27·43	67	2290	10·00	35·18	27·12	97	3165
40	8·08	35·26	27·49	61	2930	9·67	35·17	27·16	92	4110
60	7·59	35·25	27·55	54	4080	8·59	35·17	27·33	76	5790
80	7·33	35·25	27·58	53	5150	8·29	35·17	27·38	72	7270
100	7·23	35·23	27·59	53	6210	8·21	35·17	27·39	72	8710
150	6·89	35·21	27·62	51	8810	7·44	35·13	27·48	66	12160
200	6·35	35·17	27·67	47	11260	6·30	35·09	27·61	54	15160
250	5·35	35·12	27·75	40	13435	—	—	—	—	—
300	4·81	35·07	27·77	38	15385	2·36	34·96	27·95	21	18910
350	3·05	—	—	—	—	—	—	—	—	—
400	1·83	34·92	27·95	20	18285	+0·49	34·92	28·03	9	20410
450	0·84	34·92	28·02	11	19060	—	—	—	—	—
500	0·35	34·92	28·04	7	19510	−0·10	34·92	28·06	5	21110
550	0·01	34·92	28·06	6	19835	—	—	—	—	—
600	−0·19	34·92	28·07	5	20110	−0·29	34·92	28·07	4	21560
650	−0·36	34·92	28·08	4	20335	—	—	—	—	—
700	−0·52	34·92	28·08	3	20510	−0·47	34·92	28·08	2	21860
750	−0·55	34·92	28·08	1	20610	—	—	—	—	—
800	—	—	—	—	—	−0·65	34·92	28·09	0	21960
850	−0.69	34·92	28·09	0	20660	—	—	—	—	—
900	—	—	—	—	—	−0·69	34·92	28·09	0	21960
1000	−0·79	34·92	28·10	−1	20585	−0·79	34·92	28·10	0	21960

STATION SC. 19*b*.

Latitude, 60° 26′ N. ; Longitude, 4° 02′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 19/vi, 5h. a.m.—6h. 50m. a.m.					1906, 28/viii, 5h. 25m. p.m.				
0	10·75	35·37	27·14	95	0	11·85	35·33	26·89	118	0
10	10·64	35·37	27·15	92	935	11·70	35·33	26·92	114	1160
20	10·01	35·37	27·27	82	1805	11·70	35·33	26·92	114	2300
30	9·72	35·35	27·29	78	2605	11·70	33·33	26·92	114	3440
40	9·60	35·35	27·31	78	3385	11·62	35·33	26·94	112	4570
60	9·40	35·34	27·35	76	4925	10·48	35·33	27·14	94	6830
80	9·15	35·34	27·37	72	6405	9·75	35·33	27·26	84	8610
100	9·06	35·34	27·39	72	7845	9·53	35·33	27·31	80	10250
150	8·97	35·34	27·40	72	11445	9·35	35·33	27·33	79	14225
200	8·88	35·34	27·43	71	15020	9·22	35·33	27·35	77	18125
250	8·76	35·34	27·45	71	18570	—	—	—	—	—
270	—	—	—	—	—	9·05	35·33	27·38	75	23445
300	8·73	35·34	27·45	71	22120	—	—	—	—	—
350	8·54	35·34	27·48	69	25620	—	—	—	—	—
400	8·40	35·34	27·50	68	29045	—	—	—	—	—

STATION SC. 20*a*.

Latitude, 60° 17′ N. ; Longitude, 3° 36′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 19/vi, 8h. 25m. a.m.—9h. 30m. a.m.					1906, 28/viii, 10h. 5m. p.m.				
0	11·05	35·34	27·05	101	0	11·55	35·33	26·95	113	0
10	10·72	35·34	27·11	96	985	11·56	35·33	26·95	113	1130
20	9·85	35·32	27·24	84	1885	11·52	35·33	26·96	112	2255
30	9·20	35·32	27·35	72	2665	11·48	35·33	26·96	112	3375
40	8·78	35·32	27·42	67	3360	10·78	35·33	27·09	98	4425
60	8·10	35·32	27·52	57	4600	9·91	35·33	27·24	84	6245
80	8·05	35·32	27·53	57	5740	9·55	35·33	27·30	80	7885
100	8·00	35·32	27·54	57	6880	—	—	—	—	—
125	—	—	—	—	—	8·93	35·33	27·42	70	9760
150	8·00	35·32	27·54	57	9730	—	—	—	—	—

STATION SC. 21*a*.

Latitude, 60° 02′ N. ; Longitude, 3° 13′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 19/vi, 11h. 30m. a.m.—1h. 30m. p.m.					1906, 29/viii, 1h. 45m. a.m.				
0	11·65	35·32	26·92	114	0	11·55	35·31	26·94	114	0
10	10·04	35·32	27·22	85	995	11·50	35·31	26·95	113	1135
20	9·38	35·32	27·31	76	1800	11·42	35·31	26·96	110	2250
30	8·88	35·32	27·41	68	2520	11·31	35·31	26·98	108	3340
40	8·48	35·32	27·47	62	3170	11·20	35·31	27·00	107	4415
60	8·19	35·32	27·51	57	4360	9·93	35·31	27·22	86	6345
80	7·97	35·32	27·54	55	5480	9·22	35·31	27·35	75	7955
100	7·97	35·32	27·54	55	6580	9·13	35·31	27·36	75	9455
160	7·95	35·32	27·54	55	9880	—	—	—	—	—
180	—	—	—	—	—	8·74	35·31	27·42	70	15255

Station Sc. 21.

Latitude, 59° 46′ N. ; Longitude, 2° 21′ W.

Depth (Metres).	Temp. °C.	S.°/oo	σt.	v—v′	e—e′	Temp. °C.	S.°/oo	σt.	v—v′	e—e′
—	1906, 19/vi, 4h. 35m. p.m.—5h. 15m. p.m.					1906, 29/viii, 6h. 10m. a.m.				
0	11·65	35·30	26·91	116	0	11·05	35·20	26·94	113	0
10	8·82	35·30	27·41	67	915	11·82	35·20	26·98	108	1105
20	8·23	35·30	27·49	57	1535	11·66	35·22	27·03	104	2165
30	7·92	35·30	27·55	53	2085	11·61	35·22	27·04	103	3200
40	7·90	35·30	27·55	53	2615	—	—	—	—	—
50	—	—	—	—	—	11·61	35·22	27·04	104	5270
60	7·88	35·30	27·55	54	3685	—	—	—	—	—
70	—	—	—	—	—	11·61	35·22	27·04	104	7350
87	7·89	35·30	27·55	54	5143	—	—	—	—	—
90	—	—	—	—	—	11·12	35·22	27·13	97	9360

Station Sc. 22.

Latitude, 59° 36′ N. ; Longitude, 0° 41′ W.

Depth (Metres).	Temp. °C.	S.°/oo	σt.	v—v′	e—e′	Temp. °C.	S.°/oo	σt.	v—v′	e—e′
—	1906, 4/ii, 8h. 40m. p.m.—9h. 30m. p.m.					1906, 7/iv. 12 noon—12h. 45m. p.m.				
0	6·55	35·30	27·74	37	0	6·05	35·26	27·78	33	0
10	6·80	35·30	27·70	40	385	6·01	35·26	27·78	33	330
20	6·81	35·30	27·70	40	785	6·01	35·26	27·78	33	660
30	6·81	35·30	27·70	40	1185	6·01	35·26	27·78	33	990
40	6·82	35·30	27·70	40	1585	6·01	35·26	27·78	33	1320
60	6·83	35·30	27·70	41	2395	6·01	35·26	27·78	34	1990
80	6·84	35·30	27·70	41	3215	6·01	35·26	27·78	34	2670
100	6·84	35·30	27·70	42	4045	6·02	35·26	27·78	35	3360
134	6·84	35·30	27·70	42	5473	—	—	—	—	—
135	—	—	—	—	—	6·02	35·26	27·78	35	4585
—	1906, 19/vi, 11h. p.m.—11h. 50m. p.m.					1906, 26/vii, 1h. 10m. a.m.—2h. 15m. a.m.				
0	11·05	35·26	26·99	107	0	10·35	35·21	27·08	99	0
10	10·02	35·26	27·18	90	985	9·70	35·21	27·19	89	940
20	8·17	35·26	27·48	63	1750	9·30	35·23	27·27	81	1790
30	7·88	35·26	27·52	58	2355	9·22	35·25	27·29	78	2585
40	7·38	35·26	27·59	51	2900	8·92	35·25	27·35	74	3345
60	7·05	35·26	27·65	47	3880	8·18	35·26	27·47	64	4725
80	6·90	35·26	27·67	45	4800	7·18	35·26	27·62	50	5865
100	6·82	35·26	27·68	45	5700	6·86	35·26	27·67	46	6825
125	—	—	—	—	—	6·79	35·26	27·68	45	7962
138	6·71	35·26	27·69	43	7372	—	—	—	—	—
—	1906, 22/viii, 4h. 40m. a.m.					1906, 20/xi, 7h. 40m. p.m.				
0	12·05	35·22	26·77	128	0	8·05	35·23	27·46	63	0
10	12·11	35·22	26·76	130	1290	8·33	35·23	27·42	66	645
20	11·75	35·22	27·83	125	2565	8·33	35·23	27·42	66	1305
30	9·91	35·23	27·19	92	3650	8·33	35·23	27·42	66	1965
40	9·38	35·24	27·29	80	4510	8·33	35·23	27·42	66	2625
50	8·59	35·24	27·39	70	5260	—	—	—	—	—
60	7·42	35·26	27·58	53	5875	8·33	35·23	27·42	67	3955
80	6·81	35·27	27·69	44	6845	8·02	35·23	27·47	65	5275
100	6·81	35·27	27·69	44	7725	7·70	35·25	27·53	59	6515
135	6·81	35·27	27·69	44	9265	7·70	35·25	27·53	60	8597

STATION SC. 23.

Latitude, 59° 31′ N. ; Longitude, 0° 37′ E.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 29/i, 3h. 50m. p.m.—4h. 40m. p.m.					1906, 13/ii, 10h. 15m. p.m.—11h. 5m. p.m.				
0	6·75	35·30	27·71	40	0	6·25	35·28	27·76	35	0
10	7·01	35·30	27·67	43	415	6·30	35·28	27·76	35	250
20	7·03	35·30	27·67	43	845	6·30	35·28	27·76	35	700
30	7·03	35·30	27·67	43	1275	—	—	—	—	—
40	7·03	35·30	27·67	43	1705	5·92	35·28	27·81	30	1350
60	7·04	35·30	27·67	43	2565	5·89	35·28	27·82	31	1960
80	7·06	35·30	27·67	44	3435	5·82	35·28	27·82	30	2570
100	7·06	35·30	27·67	45	4325	5·76	35·28	27·83	29	3160
128	7·06	35·30	27·67	45	5585	—	—	—	—	—
132	—	—	—	—	—	5·76	35·28	27·83	29	4088
—	1906, 20/vi, 4h. a.m.—6h. 35m. a.m.					1906, 5/ix, 2h. 15m. p.m.				
0	11·95	35·16	26·74	132	0	12·95	35·18	26·57	149	0
10	9·69	35·16	27·14	73	1125	12·99	35·18	26·56	149	1490
20	8·50	35·17	27·36	73	1955	12·12	35·20	26·74	131	2890
30	7·54	35·19	27·52	58	2610	11·79	35·20	26·80	126	4175
40	6·68	35·21	27·66	45	3125	11·20	35·22	26·93	113	5370
60	6·40	35·23	27·70	41	3985	6·50	35·26	27·71	40	6900
80	6·05	35·25	27·76	35	4745	6·22	35·26	27·74	37	7670
100	6·05	35·25	27·76	35	5445	—	—	—	—	—
110	—	—	—	—	—	6·20	35·26	27·74	38	8795
126	6·05	35·25	27·76	35	6355	—	—	—	—	—
—	1906, 25/xi, 5h. 25m. p.m.					——				
0	8·25	35·21	27·41	67	0	—	—	—	—	—
10	8·35	35·21	27·42	69	680	—	—	—	—	—
20	8·33	35·21	27·42	69	1370	—	—	—	—	—
30	8·33	35·21	27·42	69	2060	—	—	—	—	—
40	8·25	35·21	27·43	67	2740	—	—	—	—	—
60	8·21	35·21	27·43	68	4090	—	—	—	—	—
80	6·52	35·25	27·70	42	5190	—	—	—	—	—
100	6·50	35·25	27·70	43	6140	—	—	—	—	—
132	6·49	35·25	27·70	44	7532	—	—	—	—	—

STATION SC. 24.

Latitude, 58° 55′ N. ; Longitude, 0° 04′ E.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 5/ii, 2h. 30m. a.m.—3h. 10m. a.m.					1906, 14/iv, 3h. 40m. a.m.—4h. 10m. a.m.				
0	6·55	35·28	27·72	39	0	6·05	35·28	27·79	32	0
10	6·96	35·28	27·66	44	415	6·16	35·28	27·78	33	325
20	7·01	35·28	27·65	44	855	6·12	35·28	27·78	33	655
30	7·01	35·28	27·65	44	1295	—	—	—	—	—
40	—	—	—	—	—	5·90	35·28	27·82	31	1295
50	7·02	35·28	27·65	44	2175	—	—	—	—	—
60	—	—	—	—	—	5·85	35·28	27·82	31	1915
70	7·02	35·28	27·65	45	3065	—	—	—	—	—
80	—	—	—	—	—	5·86	35·28	27·82	32	2545
90	6·96	35·28	27·66	45	3965	—	—	—	—	—
100	—	—	—	—	—	5·86	35·28	27·82	32	3185
115	6·96	35·28	27·66	46	5102	—	—	—	—	—
140	—	—	—	—	—	5·85	35·28	27·82	33	4485

Station Sc. 24—*continued.*

Latitude, 58° 55′ N. ; Longitude, 0° 04′ E.—*continued.*

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 20/vi, 10h. 50m. a.m.—3h. p.m.					1906. 7/ix, 10h. 55m. p.m.				
0	11·65	35·17	26·81	126	0	12·05	35·18	26·74	130	0
10	10·22	35·17	27·07	100	1130	12·05	35·18	26·74	130	1300
20	8·87	35·19	27·31	78	2020	11·94	35·20	26·77	128	2590
30	8·00	35·19	27·44	65	2735	9·93	35·22	27·17	91	3685
40	7·40	35·19	27·53	58	3350	8·52	35·24	27·41	68	4480
50	—	—	—	—	—	8·78	—	—	—	—
60	6·50	35·23	27·69	43	4360	7·23	35·24	27·60	51	5670
80	6·23	35·25	27·73	37	5160	6·61	35·24	27·68	44	6620
100	6·19	35·25	27·73	38	5910	6·19	35·24	27·73	40	7460
125	—	—	—	—	—	6·13	35·24	27·74	40	8460
127	6·19	35·25	27·73	38	6936	—	—	—	—	—
—	1906, 25/xi, 11h. p.m.					——				
0	8·55	35·21	27·38	72	0	—	—	—	—	—
10	8·60	35·21	27·39	72	720	—	—	—	—	—
20	8·50	35·21	27·39	70	1430	—	—	—	—	—
30	8·46	35·21	27·39	70	2130	—	—	—	—	—
40	8·42	35·21	27·40	70	2830	—	—	—	—	—
60	8·38	35·21	27·40	70	4230	—	—	—	—	—
80	8·00	35·23	27·47	64	5570	—	—	—	—	—
115	7·41	35·25	27·57	55	7652	—	—	—	—	—

Station Sc. 25.

Latitude, 58° 11′ N. ; Longitude, 0° 32′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 5/ii, 8h. 25m. a.m.—9h. a.m.					1906, 14/iv, 9h. 55m. a.m.—11h. 40m. a.m.				
0	6·65	35·19	27·65	47	0	6·45	35·28	27·74	38	0
10	6·97	35·19	27·60	50	485	6·46	35·28	27·74	38	380
20	7·01	35·19	27·59	51	990	6·45	35·28	27·74	38	760
30	7·02	35·19	27·59	51	1500	6·35	35·28	27·75	36	1130
50	7·03	35·19	27·59	51	2520	6·22	35·28	27·76	35	1840
70	7·04	35·19	27·59	52	3550	6·22	35·28	27·76	35	2540
90	—	—	—	—	—	6·23	35·28	27·76	36	3250
100	7·04	35·19	27·59	53	5125	—	—	—	—	—
117	—	—	—	—	—	6·23	35·28	27·76	36	4222
—	1906, 20/vi, 8h. 10m. p.m.—9h. 5m. p.m.					1906, 28/vii, 4h. 40m. a.m.—5h. 40m. a.m.				
0	11·45	35·21	26·87	117	0	11·95	35·26	26·82	125	0
10	11·43	35·21	26·87	117	1170	11·81	35·26	26·85	121	1230
20	10·00	35·21	27·14	94	2225	11·00	35·26	27·00	107	2370
30	7·77	35·21	27·51	60	2995	10·64	35·26	27·06	102	3415
40	7·33	35·21	27·56	53	3560	—	—	—	—	—
50	—	—	—	—	—	7·21	35·26	27·63	49	4925
60	6·62	35·21	27·66	45	4540	—	—	—	—	—
70	—	—	—	—	—	7·11	35·26	27·64	49	5905
80	6·61	35·21	27·66	45	5440	—	—	—	—	—
90	—	—	—	—	—	7·11	35·26	27·64	49	6885
100	6·61	35·21	27·66	46	6350	—	—	—	—	—
113	—	—	—	—	—	7·11	35·26	27·64	49	8012
124	6·59	35·21	27·66	46	7454	—	—	—	—	—

STATION Sc. 25—*continued.*

Latitude, 58° 11′ N. ; Longitude, 0° 32′ W.—*continued.*

Depth (Metres).	Temp. °C.	S.°/₀₀.	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 8/ix, 5h. 25m. a.m.					1906, 26/xi, 5h. 30m. a.m.				
0	11·85	35·17	26·76	129	0	9·35	35·21	27·25	82	0
10	11·92	35·17	26·75	129	1290	9·32	35·21	27·25	82	820
20	11·81	35·18	26·78	127	2570	9·32	35·21	27·25	82	1640
30	11·74	35·18	26·80	125	3830	9·32	35·21	27·25	82	2460
40	10·19	35·18	27·08	99	4950	9·32	35·21	27·25	82	3280
60	9·22	35·20	27·27	83	6770	9·09	35·21	27·29	80	4900
80	8·77	35·22	27·36	76	8360	8·52	35·25	27·40	70	6400
100	8·59	35·22	27·38	74	9860	—	—	—	—	—
103	—	—	—	—	—	8·59	35·25	27·39	71	8021

STATION Sc. 26.

Latitude, 58° 09′ N. ; Longitude, 1° 50′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀.	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 23/i, 6h. 15m. a.m.—7h. 15m. a.m.					1906, 6/iv, 7h. 5m. p.m.—7h. 45m. p.m.				
0	6·55	34·94	27·46	64	0	5·85	35·12	27·68	42	0
10	6·83	34·94	27·41	67	655	5·90	35·12	27·67	42	420
20	6·83	34·94	27·41	67	1325	5·75	35·12	27·69	40	830
30	6·85	34·94	27·41	67	1995	5·75	35·12	27·69	40	1230
40	6·87	34·94	27·41	67	2665	5·85	35·12	27·68	42	1640
60	6·91	34·94	27·40	68	4015	6·01	35·25	27·76	35	2410
80	6·94	34·94	27·40	69	5385	—	—	—	—	—
84	—	—	—	—	—	6·02	35·26	27·78	34	3238
—	1906, 11/vi, 11h. 25m. p.m.—12h. 25m. a.m.					1906, 18/vii, 9h. 10m. p.m.—10h. 25m. p.m.				
0	9·85	35·23	27·18	91	0	10·75	35·19	27·02	109	0
10	9·65	35·23	27·20	88	895	10·72	35·21	27·02	105	1070
15	8·12	35·23	27·45	63	1272	—	—	—	—	—
20	7·74	35·23	27·51	58	1574	10·64	35·23	27·03	102	2105
30	7·45	35·23	27·56	55	2139	8·78	35·23	27·35	74	2985
50	7·34	35·23	27·57	53	3219	8·55	35·23	27·39	71	4435
70	7·23	35·23	27·59	52	4269	8·42	35·23	27·41	69	5835
95	7·18	35·23	27·59	52	5569	—	—	—	—	—
98	—	—	—	—	—	8·42	35·23	27·41	70	7781
—	1906, 21/viii, 11h. 15m. a.m.					1906, 19/xi, 11h. 20m. p.m.				
0	11·85	35·08	26·70	137	0	9·55	34·85*	26·93	114	0
10	11·69	35·08	26·73	133	1350	10·00	34·94	26·92	114	1140
20	10·81	35·09	26·90	116	2595	10·01	34·94	26·92	114	2280
30	10·42	35·09	26·97	110	3725	10·06	34·94	26·91	115	3425
40	10·02	35·09	27·04	103	4790	—	—	—	—	—
50	—	—	—	—	—	10·06	34·94	26·91	116	5735
61	9·93	—	—	—	—	—	—	—	—	—
74	—	—	—	—	—	10·08	34·94	26·91	117	8531

* Rain in torrents.

Station Sc. 27.

Latitude, 57° 30′ N. ; Longitude, 1° 19′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 5/ii, 2h. p.m.—2h. 37m. p.m.					1906, 14/iv, 3h. 35m. p.m.—4h. 10m. p.m.				
0	6·15	34·96	27·52	58	0	5·75	34·96	27·57	53	0
10	6·33	34·96	27·50	60	590	5·71	34·96	27·57	53	530
20	6·49	34·96	27·48	62	1200	5·52	34·96	27·60	49	1040
30	6·40	34·96	27·49	61	1815	5·51	34·96	27·60	49	1530
40	—	—	—	—	—	5·51	34·96	27·60	49	2020
50	6·41	34·96	27·49	61	3035	—	—	—	—	—
60	—	—	—	—	—	5·51	34·96	27·60	50	3010
70	6·42	34·96	27·49	62	4265	—	—	—	—	—
80	—	—	—	—	—	5·52	34·96	27·60	51	4020
96	6·42	34·96	27·49	63	5890	—	—	—	—	—
103	—	—	—	—	—	5·52	34·96	27·60	51	5193
—	1906, 21/vi, 1h. 50m. a.m.—3h. 50m. a.m.					1906, 28/vii, 10h. 45m. a.m.—11h. 45m. a.m.				
0	10·35	35·19	27·06	102	0	11·05	35·12	26·88	117	0
10	10·14	35·19	27·09	97	995	10·89	35·12	26·91	115	1160
20	9·19	35·19	27·26	83	1895	10·39	35·12	26·99	107	2270
30	8·69	35·21	27·36	75	2685	9·59	35·14	27·15	93	3270
40	7·44	35·21	27·55	55	3335	9·45	35·17	27·20	90	5100
60	7·21	35·21	27·57	53	4415	9·19	35·19	27·25	84	6840
80	7·22	35·21	27·57	54	5485	9·11	35·19	27·27	83	8510
100	—	—	—	—	—	9·03	35·19	27·29	82	10407
106	7·30	35·21	27·57	55	6902	—	—	—	—	—
—	1906, 8/ix, 11h. 35m. a.m.					1906, 26/xi, 1h. 20m. p.m.				
0	12·05	35·00	26·60	145	0	9·85	34·88	26·89	117	0
10	11·88	35·00	26·63	142	1435	9·90	34·90	26·91	115	1160
20	11·78	35·00	26·65	140	2845	9·90	34·92	26·92	113	2300
30	11·44	35·00	26·72	134	4215	9·92	34·96	26·95	111	3420
40	10·99	35·00	26·80	126	5515	9·98	34·97	26·96	111	4530
60	10·58	35·00	26·88	120	7975	9·98	34·97	26·96	112	6760
80	10·52	35·00	26·89	120	10375	9·98	34·97	26·96	113	9010
114	—	—	—	—	—	9·99	34·97	26·96	113	12852
115	10·32	35·00	26·95	118	14505	—	—	—	—	—

Station Sc. 28.

Latitude, 57° 53′ N. ; Longitude, 3° 48′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 20/ii, 2h. a.m.					1906, 10/v, 12h. 5m. a.m.				
0	2·65	33·26	26·54	152	0	7·15	34·52	27·04	108	0
5	3·80	34·05	27·07	109	6525	7·29	34·54	27·18	110	1090
10	4·32	34·58	27·44	64	1085	6·00	34·83	27·44	91	2095
20	4·52	34·63	27·47	63	1720	—	—	—	—	—
29	—	—	—	—	—	5·74	34·83	27·47	87	2896
—	1906, 14/viii, 5h. 5m. p.m.					1906, 6/x, 11h. 45m. a.m.				
0	13·75	33·80	25·33	222	0	11·95	34·76	26·43	160	0
10	12·81	34·65	26·18	184	2030	11·95	34·81	26·48	156	1580
24	11·62	33·95	25·87	214	4816	—	—	—	—	—
28	—	—	—	—	—	11·98	34·85	26·49	154	4370

Station Sc. 28—*continued.*

Latitude, 57° 53′ N. ; Longitude, 3° 48′ W.

Depth (Metres).	Temp. °C.	S.°/∞	σt.	v—v′	e—e′	Temp. °C.	S.°/∞	σt.	v—v′	e—e′
—	1906, 18/xii, 8h. 50m. a.m.					———				
0	7·05	33·71	26·42	163	0	—	—	—	—	—
10	7·50	34·45	26·93	113	1380	—	—	—	—	—
25	7·88	34·76	27·13	95	2940	—	—	—	—	—

Station Sc. 30.

Latitude, 58° 00′ N. ; Longitude, 2° 54′ W.

Depth (Metres).	Temp. °C.	S.°/∞	σt.	v—v′	e—e′	Temp. °C.	S.°/∞	σt.	v—v′	e—e′
—	1906, 19/ii, 7h. 15m. p.m,					1906, 9/v, 7h. p.m.				
0	5·45	34·85	27·52	57	0	6·85	35·05	27·51	60	0
10	5 54	34·85	27·51	57	570	6·85	35·05	27·51	60	600
20	5 62	34·87	27·52	57	1140	6·81	35·05	27·52	59	1195
30	5 63	34·87	27·52	57	1710	6·60	35·05	27·54	56	1770
40	5 72	34·87	27·50	57	2280	—	—	—	—	—
54	—	—	—	—	—	6·50	35·05	27·55	55	2882
60	5·77	34·87	27·50	58	3420	—	—	—	—	—
—	1906, 14/viii, 10h. 10m. p.m.					1906, 8/x, 11h. 45m. a.m.				
0	12·55	34·88	26·41	163	0	12·05	34·90	26·53	152	0
10	12·50	34·88	26·42	162	1625	12·00	34·90	26·54	151	1515
20	11·38	34·90	26·65	140	3135	12·00	34·90	26·54	151	3030
30	10·80	34·92	26·77	128	4475	11·98	34·90	26·54	151	4545
40	10·55	34·92	26·82	123	4730	—	—	—	—	—
57	10·15	34·92	26·88	118	6778·5	11·98	34·90	26·54	151	8622
—	1906, 18/xii, 12h. 55m. p.m.					———				
0	8·05	34·85	27·16	91	0	—	—	—	—	—
10	8·18	34·88	27·18	90	915	—	—	—	—	—
20	8·15	34·88	27·18	90	1805	—	—	—	—	—
30	8·15	34·88	27·18	90	2705	—	—	—	—	—
55	8·15	34·88	27·18	90	4955	—	—	—	—	—

Station Sc. 32.

Latitude, 58° 08′ N. ; Longitude, 2° 00′ W.

Depth (Metres).	Temp. °C.	S.°/∞	σt.	v—v′	e—e′	Temp. °C.	S.°/∞	σt.	v—v′	e—e′
—	1906, 19/2, 3h. 30m. p.m.					1906, 9/v, 2h. 30m. p.m.				
0	6·15	34·99	27·56	55	0	7·05	35·07	27·49	61	0
10	6·21	34·99	27·55	56	555	7·02	35·07	27·49	61	610
20	6·21	34·99	27·55	56	1215	6·89	35·07	27·51	59	1210
30	6·21	34·99	27·55	56	1775	6·80	35·07	27·53	58	1795
40	—	—	—	—	—	6·65	35·08	27·56	55	2360
50	6·21	34·99	27·55	56	2895	—	—	—	—	—
60	—	—	—	—	—	6·37	35·21	27·69	42	3330
76	6·22	34·99	27·55	56	4351	—	—	—	—	—
88	—	—	—	—	—	6·41	35·21	27·69	42	4506

Station Sc. 32—*continued.*

Latitude, 58° 08′ N. ; Longitude 2° 00′ W.—*continued.*

Depth (Metres).	Temp. °C.	S.°/°°	σt.	v—v′	e—e′	Temp. °C.	S.°/°°	σt.	v—v′	e—e′
—	1906, 15/viii, 2h. a.m.					1906, 8/x, 4h. 10m. p.m.				
0	11·65	34·92	26·61	142	0	12·05	35·01	26·62	144	0
10	11·70	34·92	26·60	142	1420	12·00	35·01	26·63	142	1430
20	11·40	34·92	26·66	138	2820	12·00	35·01	26·63	142	2850
30	11·16	34·96	26·73	132	4170	12·00	35·03	26·64	142	4270
40	—	—	—	—	—	11·78	35·05	26·68	136	5660
50	9·93	35·05	27·01	105	6540	—	—	—	—	—
60	—	—	—	—	—	11·49	35·05	26·74	131	8330
78	9·81	35·10	27·08	100	9404	—	—	—	—	—
84	—	—	—	—	—	11·47	35·05	26·74	131	11474
—	1906, 18/xii, 5h. p.m.					———				
0	8·35	34·99	27·24	85	0	—	—	—	—	—
10	8·51	34·99	27·22	86	855	—	—	—	—	—
20	8·54	34·99	27·22	86	1715	—	—	—	—	—
30	8·58	34·99	27·21	87	2580	—	—	—	—	—
40	8·58	34·99	27·21	87	3450	—	—	—	—	—
60	8·58	34·99	27·21	87	5190	—	—	—	—	—
80	8·58	34·99	27·21	87	6930	—	—	—	—	—

Station Sc. 34.

Latitude, 58° 17′ N. ; Longitude, 1° 03′ W.

Depth (Metres).	Temp. °C.	S.°/°°	σt.	v—v′	e—e′	Temp. °C.	S.°/°°	σt.	v—v′	e—e′
—	1906, 19/ii, 11h. 45m. a.m.					1906, 9/v, 10h. 30m. a.m.				
0	6·35	35·23	27·70	41	0	6·75	35·26	27·69	42	0
10	6·61	35·23	27·67	43	420	6·78	35·26	27·69	43	425
20	6·61	35·23	27·67	43	850	6·78	35·26	27·69	43	855
30	6·61	35·23	27·67	43	1280	6·78	35·26	27·69	43	1285
50	6·62	35·23	27·67	43	2140	6·41	35·26	27·73	39	2105
70	6·63	35·23	27·67	44	3010	6·41	35·26	27·73	40	2895
90	6·65	35·23	27·67	45	3900	6·42	35·26	27·73	41	3705
110	6·65	35·23	27·67	45	4800	—	—	—	—	—
112	—	—	—	—	—	6·42	35·26	27·73	41	4625
—	1906, 15/viii, 8h. 5m. a.m.					1906, 11/x, 10h. 35m. p.m.				
0	12·50	35·17	26·64	139	0	11·75	35·01	26·67	137	0
10	12·49	35·17	26·64	139	1390	11·71	35·05	26·70	137	1370
20	10·49	35·19	27·03	104	2605	11·69	35·05	26·71	137	2740
30	9·68	35·21	27·19	88	3565	11·64	35·05	26·71	135	4100
40	—	—	—	—	—	11·28	35·14	26·84	121	5370
50	9·27	35·21	27·27	83	5275	—	—	—	—	—
60	—	—	—	—	—	10·89	35·16	26·92	112	7700
70	8·47	35·25	27·41	68	6785	—	—	—	—	—
80	—	—	—	—	—	10·52	35·16	27·00	105	9870
97	—	—	—	—	—	10·23	35·23	27·11	98	1595·5
99	8·39	35·25	27·42	68	8757	—	—	—	—	—

STATION SC. 34—*continued*.

Latitude, 58° 17′ N. ; Longitude, 1° 03′ W.—*continued*.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 18/xii, 9h. 15m. p.m.					——				
0	8·55	35·23	27·39	69	0	—	—	—	—	—
10	8·61	35·23	27·38	70	695	—	—	—	—	—
20	8·61	35·23	27·38	70	1395	—	—	—	—	—
30	8·61	35·23	27·38	70	2095	—	—	—	—	—
40	8·61	35·23	27·38	70	2795	—	—	—	—	—
60	8·62	35·23	27·38	70	4195	—	—	—	—	—
80	8·63	35·23	27·38	71	5605	—	—	—	—	—
105	8·63	35·23	27·38	72	7392·5	—	—	—	—	—

STATION SC. 35.

Latitude, 58° 22′ N. ; Longitude, 0° 36′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 19/ii, 9h. 30m. a.m.					——				
0	6·45	35·25	27·70	40	0	—	—	—	—	—
10	6·60	35·25	27·68	41	405	—	—	—	—	—
20	6·60	35·25	27·68	41	815	—	—	—	—	—
30	6·61	35·25	27·68	41	1225	—	—	—	—	—
40	6·62	35·25	27·68	41	1635	—	—	—	—	—
60	6·62	35·25	27·68	41	2455	—	—	—	—	—
80	6·63	35·25	27·68	42	3285	—	—	—	—	—
100	6·63	35·25	27·68	43	4135	—	—	—	—	—
120	6·63	35·25	27·68	43	4995	—	—	—	—	—

STATION SC. 36.

Latitude, 58° 26′ N. ; Longitude, 0° 08′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 19/ii, 7h. a.m.					1906, 9/v, 6h. 25m. a.m.				
0	6·65	35·28	27·71	38	0	6·75	35·21	27·65	45	0
10	6·63	35·28	27·71	38	380	6·71	35·21	27·65	45	450
20	6·63	35·28	27·71	38	760	6·54	35·21	27·67	43	990
30	6·63	35·28	27·71	38	1140	6·41	35·21	27·69	42	1415
40	6·63	35·28	27·71	38	1520	6·40	35·21	27·69	42	1835
60	6·63	35·28	27·71	38	2280	6·23	35·21	27·72	40	2655
80	6·63	35·28	27·71	39	3050	5·91	35·23	27·77	35	3405
100	6·63	35·28	26·71	40	3840	—	—	—	—	—
123	—	—	—	—	—	5·91	35·23	27·77	36	4931·5
138	6·64	35·28	27·71	41	4569	—	—	—	—	—

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 15/viii, 11h. 55m. a.m.					1906, 12/x, 4h. 15m. a.m.				
0	13·25	35·26	26·57	148	0	11·25	35·03	26·77	128	0
10	12·98	35·26	26·62	142	1450	11·22	35·10	26·83	121	1245
20	12·20	35·26	26·77	127	2795	11·22	35·16	26·87	117	2435
30	12·00	35·26	26·81	124	4050	10·83	25·21	27·00	107	3555
40	9·08	35·28	27·35	75	5045	10·32	35·23	27·09	95	4565
60	6·99	35·28	27·66	44	6235	9·42	35·23	27·26	82	6335
80	6·59	35·28	27·71	39	7065	7·92	35·23	27·49	59	7745
100	6·46	35·28	27·73	39	7845	7·80	35·23	27·51	58	8815
129	—	—	—	—	—	7·53	35·23	27·53	36	10468
130	6·41	35·28	27·74	39	9015	—	—	—	—	—

Station Sc. 36—*continued.*

Latitude, 58° 26′ N. ; Longitude, 0° 08′ W.—*continued.*

Depth (Metres).	Temp. °C.	S.°/°°	σt.	v—v′	e—e′	Temp. °C.	S.°/°°	σt.	v—v′	e—e′
—	1906, 19/xii, 2h. 20m. a.m.					—				
0	7·55	35·23	27·54	56	0	—	—	—	—	—
10	7·60	35·23	27·54	57	565	—	—	—	—	—
20	7·58	35·23	27·54	57	1135	—	—	—	—	—
30	7·54	35·23	27·54	56	1700	—	—	—	—	—
40	7·51	35·23	27·54	55	2255	—	—	—	—	—
60	7·51	35·23	27·54	55	3355	—	—	—	—	—
80	7·51	35·23	27·54	56	4465	—	—	—	—	—
100	7·51	35·23	27·54	57	5675	—	—	—	—	—
130	7·51	35·23	27·54	58	7400	—	—	—	—	—

Station Sc. 38.

Latitude, 58° 34′ N. ; Longitude, 0° 47′ E.

Depth (Metres).	Temp. °C.	S.°/°°	σt.	v—v′	e—e′	Temp. °C.	S.°/°°	σt.	v—v′	e—e′
—	1906, 19/ii, 2h. a.m.					1906, 9/v, 12h. 10m. a.m.				
0	6·35	35·28	27·75	37	0	6·95	35·19	27·60	50	0
10	6·42	35·28	27·74	37	370	6·93	35·19	27·60	50	500
20	6·44	35·28	27·73	37	740	6·82	35·19	27·62	49	995
30	6·44	35·28	27·73	37	1110	6·58	35·19	27·65	46	1470
40	6·45	35·28	27·73	37	1480	6·56	35·19	27·65	46	1530
60	6·46	35·28	27·73	37	2220	6·21	35·21	27·72	39	2360
80	6·47	35·28	27·73	39	2980	5·91	35·23	27·77	35	3100
100	6·47	35·28	27·73	40	3770	5·87	35·23	27·77	36	3810
150	6·49	35·28	27·73	41	5795	5·88	35·23	27·77	36	5610
—	1906, 27/vii, 10h. 20m. p.m.—11h. 45m. p.m.					1906, 15/viii, 5h. p.m.				
0	12·65	35·21	26·64	138	0	14·35	35·16	26·26	178	0
10	12·20	35·21	26·73	132	1350	14·10	35·16	26·31	173	1755
20	11·04	35·21	26·95	111	2565	13·68	35·17	26·41	163	3435
30	10·90	35·21	26·98	108	3660	13·68	35·17	26·41	163	5065
40	7·99	35·25	27·48	60	4500	10·96	35·23	26·98	108	6420
60	6·72	35·26	27·69	41	5610	7·22	35·25	27·60	50	8000
80	6·39	35·26	27·73	39	6410	6·82	35·28	27·69	43	8930
100	6·31	35·26	27·74	39	7190	6·53	35·28	27·73	41	9770
130	—	—	—	—	—	6·32	35·28	27·75	38	10955
150	6·30	35·26	26·74	40	9165	—	—	—	—	—
—	1906, 12/x, 9h. 30m. a.m.					1906, 19/xii, 6h. 45m. a.m.				
0	11·45	35·03	26·73	131	0	7·45	35·23	27·56	55	0
10	11·61	35·05	26·72	133	1320	7·50	35·23	27·55	55	550
20	11·61	35·05	26·72	133	2650	7·50	35·23	27·55	55	1100
30	11·61	35·12	56·78	126	3945	7·50	35·23	27·55	55	1650
40	9·03	35·23	27·32	78	4965	7·50	35·23	27·55	55	2200
60	7·79	35·23	27·51	59	6335	7·50	35·23	27·55	55	3300
80	7·12	35·23	27·62	51	7445	7·50	35·23	27·55	56	4410
100	6·71	35·23	27·66	46	8335	6·81	35·25	27·66	48	5450
130	—	—	—	—	—	6·67	35·25	27·68	47	6775
146	6·42	35·23	27·70	43	10382	—	—	—	—	—

STATION Sc. 39*b*.

Latitude, 57° 59′ N. ; Longitude, 0° 57′ E.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 18/ii, 8h. p.m.					1906, 8/v, 7h. 10m. p.m.				
0	6·45	35·28	27·73	38	0	7·25	35·19	27·55	54	0
10	6·59	35·28	27·71	40	390	6·78	35·19	27·62	48	510
20	6·61	35·28	27·71	40	790	6·76	35·19	27·62	48	990
30	6·61	35·28	27·71	40	1190	6·66	35·19	27·63	46	1460
40	6·61	35·28	27·71	40	1590	6·61	35·19	27·64	46	1920
60	6·62	35·28	27·71	40	2390	5·99	35·21	27·74	37	2750
80	6·62	35·28	27·71	41	3300	5·73	35·23	27·79	32	3540
100	6·61	35·28	27·71	42	4230	5·73	35·23	27·79	33	4190
135	6·61	35·28	27·71	43	5717·5	—	—	—	—	—
141	—	—	—	—	—	5·74	35·23	27·79	34	5563·5
—	1906, 15/viii, 11h. 55m. p.m.					1906, 12/x, 3h. 50m. p.m.				
0	13·85	35·23	26·40	160	0	11·25	35·14	26·86	119	0
10	13·51	35·23	26·49	155	1575	11·28	35·14	26·85	120	1195
20	11·20	35·25	26·94	111	2905	11·25	35·14	26·86	119	2390
30	10·80	35·25	27·05	104	3980	11·24	35·14	26·86	119	3580
40	9·70	35·26	27·24	85	4925	11·21	35·14	26·87	119	4770
60	7·30	35·28	27·62	49	6265	8·00	35·23	27·47	62	6580
80	7·11	35·28	27·65	48	7235	7·21	35·23	27·59	53	7740
100	7·03	35·28	27·66	47	8185	7·11	35·23	27·61	52	8790
140	—	—	—	—	—	7·02	35·23	27·62	51	10850
144	6·91	35·28	27·67	46	10231	—	—	—	—	—
—	1906, 19/xii, 1h. 5m. p.m.					——				
0	7·65	35·23	27·54	57	0	—	—	—	—	—
10	7·59	35·23	27·54	57	570	—	—	—	—	—
20	7·59	35·23	27·54	57	1140	—	—	—	—	—
30	7·59	35·23	27·54	57	1710	—	—	—	—	—
40	7·59	35·23	27·54	57	2280	—	—	—	—	—
60	7·59	35·23	27·54	57	3420	—	—	—	—	—
80	7·59	35·23	27·54	58	4570	—	—	—	—	—
100	7·55	35·23	27·55	59	5740	—	—	—	—	—
152	6·98	35·25	27·63	50	8574	—	—	—	—	—

STATION Sc. 40*b*.

Latitude, 57° 24′ N. ; Longitude, 1° 07′ E.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 18/ii, 2h. 30m. p.m.					1906, 8/v, 1h. p.m.				
0	6·35	35·21	27·70	42	0	7·25	35·12	27·49	60	0
10	6·40	35·21	27·69	43	425	6·68	35·12	27·58	52	560
20	6·33	35·21	27·70	42	850	6·45	35·12	27·61	50	1170
30	6·33	35·21	27·70	42	1270	6·40	35·12	27·62	49	1665
50	6·33	35·21	27·70	42	2110	5·91	35·12	27·68	42	2575
70	6·34	35·21	27·70	43	2960	5·87	35·12	27·68	43	3425
91	6·32	35·21	27·70	44	3873·5	—	—	—	—	—
92	—	—	—	—	—	5·88	35·12	27·68	44	4380

STATION SC. 40*b*.—*continued*.

Latitude, 57° 44′ N.; Longitude, 1° 07′ W.—*continued*.

Depth (Metres).	Temp. °C.	S.°/oo	σt.	v—v′	e—e′	Temp. °C.	S.°/oo	σt.	v—v′	e—e′
—	1906, 16/viii, 4h. 50m. a.m.					1906, 12/x, 9h. 50m. p.m.				
0	14·45	35·05	26·15	187	0	12·45	35·03	26·54	150	0
10	14·51	35·05	26·14	188	1875	12·50	35·03	26·55	150	1500
20	12·80	35·05	26·48	155	3590	12·31	35·03	26·59	147	2985
30	11·64	35·05	26·71	133	5030	12·36	35·03	26·58	148	3460
40	7·08	35·05	27·46	64	6015	9·84	35·08	27·06	100	4700
50	6·69	35·05	27·53	57	7325	7·58	35·08	27·42	67	5535
70	6·48	35·05	27·55	55	8445	7·31	35·08	27·46	66	6865
90	—	—	—	—	—	7·16	35·08	27·48	65	8175
92	6·24	35·05	27·58	53	8633	—	—	—	—	—
—	1906, 19/xii, 6h. 55m. p.m.					——				
0	8·45	35·23	27·41	69	0	—	—	—	—	—
10	8·39	35·23	27·42	67	680	—	—	—	—	—
20	8·38	35·23	27·42	67	1350	—	—	—	—	—
30	8·31	35·23	27·43	66	2015	—	—	—	—	—
40	8·28	35·23	27·43	66	2675	—	—	—	—	—
60	8·28	35·23	27·43	67	4005	—	—	—	—	—
88	8·28	35·23	27·43	68	5895	—	—	—	—	—

STATION SC. 41*a*.

Latitude, 56° 48′ N.; Longitude, 1° 19′ E.

Depth (Metres).	Temp. °C.	S.°/oo	σt.	v—v′	e—e′	Temp. °C.	S.°/oo	σt.	v—v′	e—e′
—	1906, 18/ii, 10h. a.m.					1906, 8/v, 8h. 15m. a.m.				
0	6·25	35·16	27·67	44	0	7·05	35·12	27·52	57	0
10	6·30	35·16	27·66	45	445	6·80	35·12	27·57	54	555
20	6·30	35·16	27·66	45	895	6·48	35·12	27·60	55	1100
30	6·30	35·16	27·66	45	1345	6·44	35·12	27·61	54	1645
50	6·30	35·16	27·66	45	2245	6·09	35·12	27·66	45	2635
70	6·31	35·16	27·66	46	3155	5·66	35·12	27·71	39	3475
94	6·31	35·16	27·66	47	4271	—	—	—	—	—
96	—	—	—	—	—	5·64	35·12	27·71	40	4502
—	1906, 13/viii, 7h. 25m. p.m.					1906, 13/x, 3h. 15m. a.m.				
0	14·45	34·99	26·10	192	0	13·45	34·87	26·21	181	0
10	14·74	34·99	26·05	199	1955	13·59	34·88	26·20	183	1820
20	13·20	34·99	26·37	167	3780	13·48	34·90	26·24	179	3630
30	11·20	35·01	26·77	129	5260	13·45	34·90	26·24	178	5415
40	—	—	—	—	—	6·50	34·94	27·47	63	6620
50	6·12	35·01	27·57	52	7070	6·42	34·94	26·48	62	7245
70	5·94	35·01	27·59	49	8080	6·42	34·94	27·48	63	8495
98	5·95	35·01	27·59	50	9446	6·43	34·94	27·48	64	10273
—	1906, 20/xii, 12h. 45m. a.m.					——				
0	8·25	35·19	27·40	68	0	—	—	—	—	—
10	8·28	35·19	27·40	68	680	—	—	—	—	—
20	8·28	35·19	27·40	68	1360	—	—	—	—	—
30	8·10	35·19	27·43	66	2030	—	—	—	—	—
50	8·00	35·19	27·44	64	3330	—	—	—	—	—
70	8·00	35·19	27·44	65	4620	—	—	—	—	—
95	8·00	35·19	27·44	66	6257·5	—	—	—	—	—

STATION SC. 41*b*.

Latitude, 56° 42′ N. ; Longitude, 0° 35′ E.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 18/ii, 4h. a.m.					1906, 8/v, 3h. 10m. a.m.				
0	5·75	35·12	27·69	40	0	6·85	35·07	27·52	58	0
10	6·16	35·12	27·64	45	425	6·66	35·07	27·54	55	565
20	6·16	35·12	27·64	45	875	6·45	35·07	27·57	53	1105
30	6·21	35·12	27·64	46	1330	6·42	35·07	27·58	53	1635
40	6·21	35·12	27·64	46	1795	6·16	35·07	27·61	50	2150
60	6·21	35·12	27·64	47	2725	5·89	35·07	27·64	46	3210
86	6·21	35·12	27·64	48	3960	5·89	35·07	27·64	47	4419
—	1906, 13/viii, 1h. 50m. p.m.					1906, 13/x, 8h. 15m. a.m.				
0	14·35	35·01	26·15	190	0	12·55	35·05	26·53	149	0
10	14·41	35·01	26·14	189	1895	12·52	35·05	26·54	148	1485
20	13·99	35·01	26·22	181	3745	12·51	35·05	26·54	148	2965
30	7·45	35·01	27·39	72	5010	12·15	35·05	26·61	142	4415
40	7·22	35·01	27·42	69	5715	11·13	35·05	26·80	124	5745
60	6·99	35·01	27·45	66	7065	8·44	35·05	27·27	84	7825
84	6·90	35·01	27·46	65	8637	—	—	—	—	—
86	—	—	—	—	—	8·09	35·05	27·32	80	9957
—	1906, 20/xii, 4h. 40m. a.m.					——				
0	8·35	35·23	27·42	68	0	—	—	—	—	—
10	8·50	35·23	27·40	69	685	—	—	—	—	—
20	8·50	35·23	27·40	69	1375	—	—	—	—	—
30	8·50	35·23	27·40	69	2065	—	—	—	—	—
40	8·48	35·23	27·40	69	2755	—	—	—	—	—
60	8·48	35·23	27·40	70	4145	—	—	—	—	—
84	8·48	35·23	27·40	71	5837	—	—	—	—	—

STATION SC. 41*c*.

Latitude, 56° 35′ N. ; Longitude 0° 10′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 18/ii, 1h. a.m.					1906, 7/v, 11h. 30m. p.m.				
0	5·75	35·07	27·66	44	0	6·75	35·05	27·52	57	0
10	5·96	35·07	27·64	47	455	6·59	35·05	27·54	56	565
20	5·96	35·07	27·64	47	925	6·46	35·05	27·56	55	1130
30	5·91	35·07	27·64	46	1390	6·38	35·05	27·57	54	1695
40	—	—	—	—	—	6·27	35·05	27·58	53	2230
50	5·91	35·07	27·64	47	2320	—	—	—	—	—
60	—	—	—	—	—	5·95	35·05	27·62	48	3240
78	5·92	35·07	27·64	47	3636	—	—	—	—	—
81	—	—	—	—	—	5·95	35·05	27·62	48	4248
—	1906, 13/viii, 10h. a.m.					1906, 13/x, 11h. 35m. a.m.				
0	13·95	34·88	26·12	189	0	12·65	35·05	26·51	150	0
10	13·89	34·88	26·13	188	1885	12·78	35·05	26·48	153	1515
20	12·29	34·90	26·48	155	3600	12·78	35·05	26·48	153	3045
30	7·71	34·97	27·32	77	4760	11·68	35·05	26·69	134	4480
40	7·59	34·97	27·34	75	5520	9·02	35·05	27·17	90	5600
60	7·44	34·97	27·36	75	7020	8·88	35·05	27·19	88	7380
84	7·39	34·97	27·37	76	8832	—	—	—	—	—
89	—	—	—	—	—	8·62	35·05	27·24	86	9903

Station Sc. 41*c*—*continued.*

Latitude, 56° 35′ N.; Longitude, 0° 10′ W.—*continued.*

Depth (Metres).	Temp. °C.	S.°/oo	σt.	v—v′	e—e′	Temp. °C.	S.°/oo	σt.	v—v′	e—e′
—	1906, 20/xii, 8h. 25m. a.m.					——				
0	8·65	35·10	27·29	80	0	—	—	—	—	—
10	8·65	35·12	27·29	78	790	—	—	—	—	—
20	8·68	35·12	27·29	79	1515	—	—	—	—	—
30	8·68	35·12	27·29	79	2365	—	—	—	—	—
50	8·68	35·12	27·29	80	4955	—	—	—	—	—
75	8·68	35·12	27·29	81	6967·5	—	—	—	—	—

Station Sc. 42.

Latitude, 56° 28′ N.; Longitude, 0° 53′ W.

Depth (Metres).	Temp. °C.	S.°/oo	σt.	v—v′	e—e′	Temp. °C.	S.°/oo	σt.	v—v′	e—e′
—	1906, 17/ii, 7h. p.m.					1906, 7/v, 8h. 45m. p.m.				
0	5·55	35·03	27·66	44	0	6·75	34·87	27·38	70	0
10	5·71	35·03	27·64	46	450	6·55	34·87	27·40	68	690
20	5·71	35·03	27·64	46	910	6·18	34·87	27·44	64	1350
30	5·71	35·03	27·64	46	1370	5·89	34·87	27·48	59	1965
40	—	—	—	—	—	5·82	34·87	27·49	58	2550
50	5·71	35·03	27·64	46	2290	5·83	34·87	27·49	58	3130
70	—	—	—	—	—	5·84	34·87	27·49	59	4300
71	5·73	35·03	27·64	47	3366·5	—	—	—	—	—
—	1906, 13/viii, 3h. 50m. a.m.					1906, 20/x, 9h. 40m. p.m.				
0	12·85	34·81	26·30	173	0	10·65	34·96	26·83	123	0
10	11·82	34·85	26·52	151	1620	10·85	34·96	26·79	125	1240
20	8·91	34·90	27·06	100	2875	10·85	34·96	26·79	125	2490
30	8·45	34·90	27·16	93	3840	10·85	34·96	26·79	125	3740
50	8·30	34·90	27·18	92	5690	10·85	34·96	26·79	125	6240
69	8·30	34·90	27·18	92	7438	—	—	—	—	—
70	—	—	—	—	—	10·85	34·96	26·79	125	8740
—	1906, 20/xii, 12h. 35m. p.m.					——				
0	8·45	35·01	27·25	85	0	—	—	—	—	—
10	8·51	35·01	27·24	86	855	—	—	—	—	—
20	8·51	35·01	27·24	86	1715	—	—	—	—	—
30	8·51	35·01	27·24	86	2575	—	—	—	—	—
50	8·51	35·01	27·24	86	4295	—	—	—	—	—
70	8·51	35·01	27·24	86	6015	—	—	—	—	—

Station Sc. 43.

Latitude, 56° 24′ N.; Longitude, 1° 21′ W.

Depth (Metres).	Temp. °C.	S.°/oo	σt.	v—v′	e—e′	Temp. °C.	S.°/oo	σt.	v—v′	e—e′
—	1906, 17/ii, 5h. p.m.					1906, 7/v, 4h. 15m. p.m.				
0	5·45	34·99	27·64	46	0	6·85	34·72	27·24	83	0
10	5·62	34·99	27·62	48	470	6·62	34·74	27·30	78	805
20	5·65	34·99	27·61	48	950	6·38	34·74	27·32	76	1575
30	5·65	34·99	27·61	48	1430	5·89	34·76	27·39	68	2295
40	5.65	34·99	27·61	48	1910	5·80	34·76	27·40	68	2975
63	—	—	—	—	—	5·80	34·76	27·40	68	4539
64	5·68	34·99	27·61	49	3154	—	—	—	—	—

Station Sc. 43—*continued.*

Latitude, 56° 24′ N.; Longitude, 1° 21′ W.—*continued.*

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 10/viii, 3h. 15m. a.m.					1906, 20/x, 7h. 5m. p.m.				
0	12·35	34·72	26·32	170	0	10·95	34·88	26·71	134	0
10	11·85	34·76	26·45	157	1635	11·06	34·88	26·68	136	1350
20	9·30	34·88	27·00	108	2960	11·08	34·88	26.68	136	2710
30	9·15	34·90	27·04	104	3020	11·08	34·88	26·68	136	4070
40	9·10	34·90	27·05	103	4055	11·08	34·88	26·68	136	5430
60	9·10	34·90	27·05	103	6115	11·08	34·88	26·68	136	8150
—	1906, 20/xii, 3h. p.m.					———				
0	8·25	34·92	27·18	88	0	—	—	—	—	—
10	8·44	34·92	27·16	93	905	—	—	—	—	—
20	8·44	34·92	27·16	93	1835	—	—	—	—	—
30	8·44	34·92	27·16	93	2765	—	—	—	—	—
50	8·44	34·92	27·16	93	4625	—	—	—	—	—
70	8·44	34·92	27·16	93	6485	—	—	—	—	—

Station Sc. 44.

Latitude, 56° 20′ N.; Longitude, 1° 49′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 17/ii, 1h. 30m. p.m.					1906, 7/v, 12h. 15m. p.m.				
0	5·45	34·96	27·61	50	0	6·45	34·40	27·04	103	0
10	5·40	34·94	27·60	49	495	6·31	34·42	27·07	101	1020
20	5·40	34·94	27·60	49	985	5·98	34·47	27·16	91	1980
30	5·40	34·94	27·60	49	1475	5·71	34·49	27·21	86	2855
50	—	—	—	—	—	5·71	34·49	27·21	86	4575
53	5·42	34·94	27·60	49	2602	—	—	—	—	—
—	1906, 9/viii, 11h. 30m. p.m.					1906, 23/x, 4h. 30m. p.m.				
0	12·15	34·63	26·29	173	0	11·05	34·83	26·65	139	0
10	10·24	34·79	26·76	129	1510	11·08	34·83	26·64	140	1395
20	10·20	34·81	26·79	127	2790	11·08	34·83	26·64	140	2795
30	10·20	34·81	26·79	127	4060	11·08	34·83	26·64	140	4195
40	10·18	34·81	26·79	127	5330	—	—	—	—	—
48	—	—	—	—	—	11·08	34·83	26·64	140	6815
61	10·05	34·81	26·82	125	8976	—	—	—	—	—
—	1906, 20/xii, 5h. 50m. p.m.					———				
0	8·35	34·83	27·11	95	0	—	—	—	—	—
10	8·41	34·83	27·10	97	960	—	—	—	—	—
20	8·41	34·83	27·10	97	1930	—	—	—	—	—
30	8·41	34·83	27·10	97	2900	—	—	—	—	—
57	8·41	34·83	27·10	97	5519	—	—	—	—	—

Station Sc. 45.

Latitude, 56° 16′ N. ; Longitude, 2° 17′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 18/i, 1h. 20m. p.m.					1906, 17/ii, 11h. a.m.				
0	4·85	33·80	26·77	128	0	5·05	34·61	27·38	71	0
10	5·93	33·84	26·67	138	1330	5·12	34·65	27·39	68	695
20	6·32	34·42	27·07	100	2520	5·13	34·79	27·51	58	1325
30	6·43	34·54	27·16	92	3480	5·34	34·87	27·55	54	1885
48	—	—	—	—	—	5·34	34·87	27·55	54	2857
55	6·44	34·54	27·16	92	5780	—	—	—	—	—

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 5/v, 4h. 30m. p.m.					1906, 9/viii, 8h. 10m. p.m.				
0	6·15	34·36	27·05	102	0	12·45	34·54	26·16	186	0
10	5·98	34·38	27·09	99	1005	11·62	34·60	26·37	165	1755
20	5·58	34·42	27·16	90	1950	11·49	34·65	26·42	160	3380
30	5·33	34·43	27·21	99	2895	10·21	34·70	26·70	135	4855
40	—	—	—	—	—	10·21	34·72	26·71	134	6200
54	5·36	34·43	27·21	100	5283	—	—	—	—	—
57	—	—	—	—	—	10·21	34·72	26·71	134	8478

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 20/x, 2h. 15m. p.m.					1906, 20/xii, 9h. 30m. p.m.				
0	11·15	34·78	26·58	145	0	7·05	33·58	26·32	172	0
10	11·22	34·78	26·57	146	1455	7·59	34·25	26·77	128	1000
20	11·26	34·78	26·56	146	2915	7·68	34·38	26·86	119	2235
30	11·26	34·78	26·56	146	4375	—	—	—	—	—
43	—	—	—	—	—	7·82	34·40	26·86	120	4983·5
58	11·28	34·78	26·56	146	8463	—	—	—	—	—

Station Sc. 46.

Latitude, 56° 10′ N. ; Longitude, 2° 45′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 18/i, 9h. 35m. a.m.					1906, 13/ii, 10h. a.m.				
0	6·05	34·42	27·11	96	0	5·05	34·27	27·11	96	0
10	6·13	34·42	27·09	98	970	5·23	34·27	27·09	99	975
20	6·19	34·42	27·08	98	1950	5·23	34·27	27·09	99	1965
30	6·17	34·42	27·09	98	2930	5·23	34·27	27·09	99	2955
46	6·23	34·42	27·08	99	4506	—	—	—	—	—
53	—	—	—	—	—	5·26	34·27	27·09	99	5232

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 5/v, 11h. a.m.					1906, 7/viii, 9h. 5m. a.m.				
0	6·35	34·29	26·97	109	0	11·05	34·52	26·42	162	0
10	6·05	34·33	27·03	103	1060	11·01	34·54	26·44	160	1610
20	5·82	34·36	27·09	99	2070	11·01	34·54	26·44	160	3210
30	5·41	34·36	27·14	94	3035	—	—	—	—	—
34	—	—	—	—	—	11·05	34·54	26·44	161	5471
42	5·41	34·36	27·14	94	4163	—	—	—	—	—

STATION SC. 46—*continued.*

Latitude, 56° 10′ N. ; Longitude, 2° 45′ W.—*continued.*

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 20/x, 11h. 30m. a.m.					1906, 20/xii, 11h. 35m. p.m.				
0	10·85	34·43	26·67	166	0	7·35	34·36	26·89	118	0
10	10·91	34·49	26·71	162	1640	7·55	34·40	26·90	117	1175
20	11·01	34·52	26·74	161	3255	—	—	—	—	—
23	—	—	—	—	—	7·62	34·40	26·89	118	2702·5
37	11·06	34·52	26·74	162	6000·5	—	—	—	—	—

STATION SC. 47.

Latitude, 58° 24′ N. ; Longitude, 2° 45′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 5/vii, 8h. 55m. a.m.—10h. a.m.					—				
0	10·05	35·07	27·01	104	0	—	—	—	—	—
10	9·76	35·07	27·06	101	1025	—	—	—	—	—
20	9·36	35·07	27·13	95	2005	—	—	—	—	—
30	9·20	35·07	27·16	92	2940	—	—	—	—	—
40	8·89	35·08	27·22	87	3835	—	—	—	—	—
50	8·86	35·08	27·23	88	4710	—	—	—	—	—
75	8·86	35·08	27·23	88	6910	—	—	—	—	—

STATION SC. 48.

Latitude, 58° 44′ N. ; Longitude, 3° 10′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 5/vii, 12h. 35m. p.m.—1h. 40m. p.m.					—				
0	9·65	35·03	27·05	102	0	—	—	—	—	—
10	9·41	35·03	27·10	97	995	—	—	—	—	—
20	9·39	35·03	27·10	97	1965	—	—	—	—	—
30	9·39	35·03	27·10	98	2940	—	—	—	—	—
40	9·39	35·03	27·10	98	3920	—	—	—	—	—
60	9·39	35·03	27·10	99	5890	—	—	—	—	—
82	9·39	35·03	27·10	99	8068	—	—	—	—	—

STATION SC. 49.

Latitude, 59° 00′ N. ; Longitude, 4° 00′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 5/vii, 4h. 30m. p.m.—7h. p.m.					1906, 17/ix, 10h. a.m.				
0	9·65	34·97	27·02	107	0	12·05	35·12	26·70	136	0
10	9·62	34·97	27·02	106	1065	—	—	—	—	—
20	9·02	34·96	27·11	97	2080	11·94	35·12	26·72	134	2700
30	8·94	34·96	27·12	96	3045	—	—	—	—	—
49	8·92	34·96	27·13	96	4869	—	—	—	—	—
50	—	—	—	—	—	11·91	35·12	26·72	134	6720
91	—	—	—	—	—	11·91	35·12	26·72	136	12255

STATION Sc. 54.

Latitude, 59° 10′ N. ; Longitude, 7° 00′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 12/vii, 2h. 25m. a.m.—5h. 45m. a.m.					———				
0	11·15	35·37	27·06	102	0	—	—	—	—	—
10	11·42	35·37	27·01	105	1035	—	—	—	—	—
20	11·32	35·37	27·03	103	2075	—	—	—	—	—
30	11·10	35·37	27·07	101	3095	—	—	—	—	—
40	10·50	35·37	27·18	91	4055	—	—	—	—	—
60	9·72	35·37	27·31	79	5755	—	—	—	—	—
80	9·41	35·34	27·33	78	7325	—	—	—	—	—
100	9·37	35·35	27·35	77	8875	—	—	—	—	—
182	9·17	35·35	27·38	75	15107	—	—	—	—	—

STATION Sc. 55.

Latitude, 58° 44′ N. ; Longitude, 7° 00′ W.

—	1906, 11/vii, 8h. 40m. p.m.—11h. 40m. p.m.					———				
0	11·35	35·37	27·03	106	0	—	—	—	—	—
10	11·30	35·37	27·03	105	1055	—	—	—	—	—
20	11·22	35·37	27·05	103	2095	—	—	—	—	—
30	11·10	35·37	27·07	102	3120	—	—	—	—	—
40	10·25	35·37	27·23	88	4070	—	—	—	—	—
60	9·13	35·35	27·40	71	5660	—	—	—	—	—
80	8·91	35·35	27·44	68	7050	—	—	—	—	—
108	8·91	35·35	27·44	69	8968	—	—	—	—	—

STATION Sc. 56.

Latitude, 58° 44′ N. ; Longitude, 6° 00′ W.

—	1906, 11/vii, 2h. 25m. p.m.—5h. 35m. p.m.					———				
0	11·35	35·26	26·93	107	0	—	—	—	—	—
10	11·50	35·26	26·91	109	1080	—	—	—	—	—
20	11·40	35·26	26·93	107	2160	—	—	—	—	—
30	10·80	35·26	27·04	97	3180	—	—	—	—	—
50	10·40	35·26	27·11	90	5050	—	—	—	—	—
60	8·77	35·26	27·39	66	6610	—	—	—	—	—
70	8·52	35·26	27·43	63	7255	—	—	—	—	—
90	8·23	35·26	27·47	58	8465	—	—	—	—	—
115	8·23	35·26	27·47	58	9915	—	—	—	—	—

STATION Sc. 57.

Latitude, 58° 44′ N. ; Longitude, 5° 00′ W.

—	1906, 12/vii, 2h. 25m. a.m.—5h. 45m. a.m.					———				
0	10·45	34·92	26·82	123	0	—	—	—	—	—
10	10·20	34·92	26·87	118	1205	—	—	—	—	—
20	10·60	34·92	26·80	125	2420	—	—	—	—	—
30	10·49	34·92	26·82	124	3665	—	—	—	—	—
40	10·39	34·92	26·84	122	4895	—	—	—	—	—
60	9·70	34·94	26·97	111	7225	—	—	—	—	—
88	9·17	34·99	27·10	100	10179	—	—	—	—	—

Station Sc. 58.

Latitude, 58° 44′ N. ; Longitude, 4° 00′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 12/vii, 7h. p.m.—9h. 40m. p.m.					——				
0	10·55	34·88	26·79	128	0	—	—	—	—	—
10	10·41	34·88	26·81	125	1265	—	—	—	—	—
20	9·88	34·90	26·93	115	2465	—	—	—	—	—
30	9·72	34·90	26·96	113	3605	—	—	—	—	—
40	9·61	34·90	26·97	111	4725	—	—	—	—	—
60	9·29	34·90	27·02	108	6915	—	—	—	—	—
80	9·22	34·90	27·03	106	9055	—	—	—	—	—
105	9·21	34·90	27·03	107	11717	—	—	—	—	—

Station Sc. 24*a*.

Latitude, 58° 54′ N. ; Longitude, 1° 05′ E.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 27/vii, 4h. 50m. p.m.—6h. 50m. p.m.					——				
0	12·75	35·21	26·62	141	0	—	—	—	—	—
10	11·59	35·21	26·85	121	1310	—	—	—	—	—
20	10·54	35·21	27·05	102	2425	—	—	—	—	—
30	10·31	35·21	27·09	99	3430	—	—	—	—	—
40	9·12	35·23	27·30	79	4320	—	—	—	—	—
50	7·29	35·25	27·59	52	4975	—	—	—	—	—
60	6·82	35·26	27·68	44	5455	—	—	—	—	—
80	6·39	35·26	27·73	39	6285	—	—	—	—	—
100	6·29	35·26	27·74	39	7065	—	—	—	—	—
125	6·21	35·26	27·75	38	8027	—	—	—	—	—

Station Sc. 23*a*.

Latitude, 59° 27′ N. ; Longitude, 1° 32′ E.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 27/vii, 10h. 50m. a.m.—12h. 55m. p.m.					——				
0	11·85	35·21	26·80	126	0	—	—	—	—	—
10	10·39	35·21	27·07	100	1130	—	—	—	—	—
20	9·79	35·21	27·17	90	2080	—	—	—	—	—
30	9·24	35·21	27·27	81	2935	—	—	—	—	—
40	7·78	35·25	27·52	58	3630	—	—	—	—	—
60	6·50	35·26	27·72	40	4610	—	—	—	—	—
80	6·49	35·26	27·72	41	5420	—	—	—	—	—
115	6·49	35·26	27·72	41	6855	—	—	—	—	—

Station Sc. 6*b*.

Latitude, 60° 00′ N. ; Longitude, 2° 02′ E.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 27/vii, 4h. 25m. a.m.—6h. 40m. a.m.					——				
0	11·75	35·07	26·70	135	0	—	—	—	—	—
10	11·46	35·07	26·76	130	1325	—	—	—	—	—
20	10·22	35·07	26·98	107	2510	—	—	—	—	—
30	10·06	35·08	27·02	105	3570	—	—	—	—	—
40	7·40	35·25	27·55	52	4355	—	—	—	—	—
60	6·85	35·26	27·67	45	5325	—	—	—	—	—
80	6·76	35·26	27·68	45	6225	—	—	—	—	—
107	6·76	35·26	27·68	45	7440	—	—	—	—	—

Station Sc. 11*a*.

Latitude, 61° 42′ N. ; Longitude, 2° 00′ W.

Depth (Metres).	Temp. °C.	S.°/oo	σt.	v—v′	e—e′	Temp. °C.	S.°/oo	σt.	v—v′	e—e′
—	1906, 11/iv, 5h. 20m. p.m.—10h. p.m.					1906, 1/ix, 11h. p.m.				
0	7·35	35·32	27·64	46	0	11·00	35·25	26·98	108	0
10	7·44	35·32	27·63	46	460	11·10	35·25	26·96	110	1090
20	7·34	35·32	27·64	46	920	11·00	35·25	26·98	108	2180
30	7·28	35·32	27·65	45	1375	10·88	35·26	27·02	105	3245
40	7·23	35·32	27·65	44	1820	9·78	35·28	27·21	85	4195
60	7·22	35·32	27·65	45	2710	9·21	35·30	27·35	75	5795
80	7·22	35·32	27·65	45	3610	9·07	35·32	27·38	73	7275
100	7·22	35·32	27·65	46	4520	8·99	35·32	27·39	72	8725
150	7·03	35·26	27·65	48	6870	8·92	35·32	27·40	72	12325
200	6·89	35·25	27·65	48	9270	8·82	35·32	27·42	71	15900
250	6·54	35·21	27·67	48	11670	—	—	—	—	—
300	—	—	—	—	—	8·30	35·28	27·46	69	22900
350	5·98	35·14	27·69	48	16470	—	—	—	—	—
400	—	—	—	—	—	8·06	35·25	27·47	71	29900
450	5·04	35·07	27·75	40	20870	—	—	—	—	—
500	3·86	34·96	27·78	37	22795	7·10	35·17	27·57	63	36600
550	2·77	34·94	27·89	27	24395	—	—	—	—	—
600	—	—	—	—	—	4·56	34·99	27·74	45	42000
650	1·63	34·94	28·02	12	26345	—	—	—	—	—
700	—	—	—	—	—	1·45	34·92	27·97	18	45150
750	0·31	34·94	28·06	7	27295	—	—	—	—	—
800	—	—	—	—	—	—	34·92	—	—	—
850	0·11	34·94	28·075	5	27895	—	—	—	—	—
900	—	—	—	—	—	+0·66	34·92	28·03	12	48150
1000	−0·12	34·94	28·085	4	28570	−0·39	34·92	28·08	2	48850
1300	—	—	—	—	—	−0·96	34·92	28·11	0	49150
	(Wire insufficient to reach bottom.)									

Station Sc. 50.

Latitude, 59° 21′ N. ; Longitude, 5° 00′ W.

Depth (Metres).	Temp. °C.	S.°/oo	σt.	v—v′	e—e′	Temp. °C.	S.°/oo	σt.	v—v′	e—e′
—	1906, 5/vii, 11h. p.m.—2h. a.m.					1906, 17/ix, 2h. 30m. p.m.				
0	10·85	35·35	27·10	99	0	12·25	35·23	26·73	133	0
10	11·12	35·35	27·05	103	1010	12·22	35·23	26·74	133	2260
20	11·12	35·34	27·04	104	2045	10·98	35·23	26·97	110	6305
30	10·68	35·34	27·12	88	3005	—	—	—	—	—
40	10·24	35·34	27·19	88	3885	—	—	—	—	—
50	8·84	35·32	27·42	67	4660	—	—	—	—	—
60	8·76	35·30	27·42	69	5340	—	—	—	—	—
80	8·40	35·30	27·47	64	6670	—	—	—	—	—
100	8·32	35·30	27·48	63	7940	—	—	—	—	—
115	—	—	—	—	—	9·52	35·23	27·24	88	12740
125	8·27	35·30	27·49	63	9515	—	—	—	—	—

Station Sc. 51.

Latitude, 59° 41′ N. ; Longitude, 6° 00′ W.

Depth (Metres).	Temp. °C.	S.°/oo	σt.	v—v′	e—e′	Temp. °C.	S.°/oo	σt.	v—v′	e—e′
—	1906, 6/vii, 5h. 55m. a.m.—9h. 30m. a.m.					1906, 17/ix, 7h. 30m. p.m.				
0	10·75	35·37	27·14	95	0	12·15	35·23	26·75	131	0
10	10·78	35·37	27·13	95	950	—	—	—	—	—
20	10·59	35·37	27·16	92	1885	12·11	35·23	26·76	131	2620
30	10·30	35·37	27·22	88	2785	—	—	—	—	—
40	10·19	35·37	27·23	87	3660	12·10	35·23	26·76	131	5240
60	9·86	35·37	27·28	82	5350	11·86	35·23	26·80	126	7810
80	9·39	35·35	27·34	76	6930	9·99	35·23	27·15	95	10020
100	9·21	35·35	27·38	73	8420	—	—	—	—	—
150	8·98	35·35	27·43	71	12020	—	—	—	—	—
165	—	—	—	—	—	9·32	35·23	27·26	85	17670
230	8·48	35·35	27·50	54	17020	—	—	—	—	—

Station Sc. 51*a*.

Latitude, 59° 47′ N.; Longitude, 6° 19′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 17/ix, 10h. p.m.					——				
0	12·15	35·25	26·76	128	0	—	—	—	—	—
20	12·10	35·25	26·77	128	2560	—	—	—	—	—
60	12·09	35·25	26·77	129	7700	—	—	—	—	—
80	12·09	35·25	26·77	130	10290	—	—	—	—	—
100	9·99	35·25	27·16	96	12550	—	—	—	—	—
235	9·31	35·25	27·27	85	24767	—	—	—	—	—

Station Sc. 51*b*.

Latitude, 59° 53′ N.; Longitude, 6° 38′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 17/ix, 11h. 50m. p.m.					——				
0	11·95	35·28	26·83	123	0	—	—	—	—	—
20	11·88	35·28	26·84	121	2440	—	—	—	—	—
60	11·70	35·28	26·88	117	7200	—	—	—	—	—
80	9·80	35·28	27·24	87	9240	—	—	—	—	—
100	9·33	35·28	27·30	80	10910	—	—	—	—	—
200	8·75	35·28	27·59	72	18510	—	—	—	—	—
400	8·39	35·28	27·45	70	32710	—	—	—	—	—
800	8·09	35·28	27·50	75	61610	—	—	—	—	—

Station Sc. 52.

Latitude, 60° 00′ N.; Longitude, 7° 00′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 6/vii, 1h. 30m. p.m.—6h. p.m.					1906, 18/ix, 3h. 25m. a.m.				
0	11·45	35·37	27·00	107	0	11·35	35·30	26·97	111	0
10	11·28	35·37	27·03	103	1050	—	—	—	—	—
20	10·79	35·37	27·13	95	2040	11·36	35·30	26·97	111	2220
30	10·39	35·37	27·20	89	2960	—	—	—	—	—
40	10·01	35·37	27·27	82	3815	10·90	35·30	27·05	102	4350
60	9·09	35·35	27·39	71	5345	9·92	35·30	27·22	88	6250
80	8·73	35·35	27·47	65	6705	—	—	—	—	—
100	8·63	35·35	27·48	64	7995	9·22	35·30	27·34	77	9550
250	8·32	35·34	27·50	64	17595	—	—	—	—	—
400	—	—	—	—	—	8·36	35·30	27·47	71	31750
500	8·14	35·34	27·53	66	33845	—	—	—	—	—
750	8·04	35·32	27·53	72	51095	—	—	—	—	—
800	—	—	—	—	—	8·11	35·30	27·52	76	61150
1000	7·39	35·30	27·62	68	68595	—	—	—	—	—

Station Sc. 52*a*.

Latitude, 59° 55′ N.; Longitude, 7° 06′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 18/ix, 9h. 15m. a.m.					——				
0	11·35	35·25	26·91	115	0	—	—	—	—	—
20	11·30	35·25	26·92	114	2290	—	—	—	—	—
40	11·28	35·25	26·93	114	4570	—	—	—	—	—
60	11·21	35·25	26·94	114	6850	—	—	—	—	—
100	9·30	35·25	27·28	83	10790	—	—	—	—	—
500	8·29	35·25	27·44	76	42590	—	—	—	—	—
900	7·96	35·23	27·47	81	73990	—	—	—	—	—

STATION SC. 52*b*.

Latitude, 59° 48′ N. ; Longitude, 7° 25′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 20/ix, 11h. 55m. p.m.							——		
0	10·85	35·25	27·01	107	0	—	—	—	—	—
20	10·88	35·25	27·00	108	2150	—	—	—	—	—
50	10·78	35·25	27·02	106	5360	—	—	—	—	—
100	10·01	35·25	27·16	95	10385	—	—	—	—	—
522	8·04	35·25	27·48	72	45622	—	—	—	—	—

STATION SC. 52*c*.

Latitude, 60° 09′ N. ; Longitude, 6° 35′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 21/ix, 4h. 15m. a.m.							——		
0	10·95	35·23	26·98	109	0	—	—	—	—	—
20	10·99	35·23	26·97	110	2190	—	—	—	—	—
50	10·61	35·23	27·04	103	5385	—	—	—	—	—
100	9·22	35·23	27·28	83	10035	—	—	—	—	—
200	8·56	35·23	27·39	76	17985	—	—	—	—	—
400	8·15	35·21	27·44	75	33085	—	—	—	—	—
500	6·56	35·16	27·62	58	39735	—	—	—	—	—
600	3·78	34·96	27·79	39	44585	—	—	—	—	—

STATION SC. 52*d*.

Latitude, 60° 17′ N. ; Longitude, 6° 11′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 21/ix, 8h. 55m. a.m.							——		
0	9·45	35·14	27·17	91	0	—	—	—	—	—
20	9·66	35·14	27·13	94	1850	—	—	—	—	—
50	9·21	35·14	27·21	87	4565	—	—	—	—	—
100	8·31	35·14	27·36	76	8640	—	—	—	—	—
200	7·47	35·14	27·48	66	15740	—	—	—	—	—
300	6·25	35·12	27·64	53	21690	—	—	—	—	—
400	4·31	35·05	27·81	35	26090	—	—	—	—	—
500	2·61	34·92	27·88	28	29240	—	—	—	—	—
600	0·64	34·92	28·02	11	31190	—	—	—	—	—
800	+0·01	34·92	28·06	6	32890	—	—	—	—	—
1100	−0·86	34·92	28·10	−1	33640	—	—	—	—	—

STATION SC. 52*e*.

Latitude, 60° 09′ N. ; Longitude, 5° 53′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′	Temp. °C.	S.°/₀₀	σt.	v—v′	e—e′
—	1906, 21/ix, 1h. 10m. p.m.							——		
0	10·35	35·21	27·08	102	0	—	—	—	—	—
20	10·05	35·21	27·13	97	1990	—	—	—	—	—
50	9·61	35·21	27·21	90	4795	—	—	—	—	—
100	8·39	35·21	27·40	74	8895	—	—	—	—	—
200	7·61	35·21	27·53	64	15795	—	—	—	—	—
300	6·61	35·19	27·64	52	21595	—	—	—	—	—
400	—	35·19	—	—	—	—	—	—	—	—
500	1·60	34·92	27·96	18	28595	—	—	—	—	—
600	+0·35	34·92	28·05	9	29945	—	—	—	—	—
1200	−0·83	34·92	28·10	−1	32945	—	—	—	—	—

Station Sc. 52*f*.

Latitude, 60° 02′ N. ; Longitude, 5° 39′ W.

Depth (Metres).	Temp. °C.	S.°/°°	σt.	v—v′	e—e′	Temp. °C.	S.°/°°	σt.	v—v′	e—e′
—	1906, 21/ix, 5h. 30m. p.m.					——				
0	11·15	35·30	27·00	108	0	—	—	—	—	—
20	10·39	35·30	27·14	94	2020	—	—	—	—	—
50	9·88	35·30	27·22	87	4735	—	—	—	—	—
100	9·69	35·30	27·25	85	9035	—	—	—	—	—
200	8·42	35·28	27·45	70	16785	—	—	—	—	—
300	8·25	35·26	27·46	71	23835	—	—	—	—	—
400	4·73	35·07	27·78	38	29285	—	—	—	—	—

Station Sc. 52*g*.

Latitude, 59° 53′ N. ; Longitude, 5° 20′ W.

Depth (Metres).	Temp. °C.	S.°/°°	σt.	v—v′	e—e′	Temp. °C.	S.°/°°	σt.	v—v′	e—e′
—	1906, 21/ix, 7h. 30m. p.m.					——				
0	11·35	35·32	26·98	109	0	—	—	—	—	—
20	11·01	35·32	27·04	102	2110	—	—	—	—	—
50	10·10	35·32	27·20	88	4960	—	—	—	—	—
100	9·61	35·32	27·28	82	9210	—	—	—	—	—
200	9·33	35·32	27·32	80	17310	—	—	—	—	—
355	9·05	35·32	27·37	78	29555	—	—	—	—	—

Station Sc. 52*h*.

Latitude, 59° 44′ N. ; Longitude, 5° 02′ W.

Depth (Metres).	Temp. °C.	S.°/°°	σt.	v—v′	e—e′	Temp. °C.	S.°/°°	σt.	v—v′	e—e′
—	1906, 21/ix, 10h. p.m.					——				
0	11·85	35·32	26·88	118	0	—	—	—	—	—
20	12·10	35·32	26·83	122	2400	—	—	—	—	—
50	10·70	35·32	27·09	98	5700	—	—	—	—	—
100	9·80	35·32	27·25	85	10275	—	—	—	—	—
152	9·54	35·32	27·29	81	14591	—	—	—	—	—

Station Sc. 53.

Latitude, 59° 36′ N. ; Longitude, 7° 00′ W.

Depth (Metres).	Temp. °C.	S.°/°°	σt.	v—v′	e—e′	Temp. °C.	S.°/°°	σt.	v—v′	e—e′
—	1906, 6/vii, 8h. 35m. p.m.—3h. 45m. a.m.					——				
0	11·75	35·37	26·94	113	0	—	—	—	—	—
10	11·75	35·37	26·94	113	1130	—	—	—	—	—
20	10·66	35·37	27·15	93	2110	—	—	—	—	—
30	9·83	35·37	27·30	80	2975	—	—	—	—	—
40	9·26	35·35	27·37	74	3745	—	—	—	—	—
60	8·98	35·35	27·43	69	5175	—	—	—	—	—
80	8·90	35·35	27·44	68	6545	—	—	—	—	—
100	8·83	35·35	27·45	67	7895	—	—	—	—	—
250	8·41	35·34	27·50	65	17795	—	—	—	—	—
500	8·18	35·34	27·53	67	34295	—	—	—	—	—
750	8·18	35·32	27·52	74	51910	—	—	—	—	—
1000	7·95	35·30	27·54	79	71045	—	—	—	—	—

SURFACE OBSERVATIONS, JANUARY—FEBRUARY 1906.

Station.	Time.		Locality.		Air.	Water.	
	Date.	Hour.	Latitude.	Longitude.	Temp. °C.	Temp. °C.	S.°/₀₀
			° ′	° ′			
Sc. 26	23 Jan.	7 a.m.	58 09 N.	1 50 W.	5·6	6·55	34·94
	„	8 „	9 miles N.N.E.		5·8	6·85	34·99
	„	9 „	18 „		7·0	7·05	35·03
Sc. 2	„	11 „	58 36 N.	1 46 W.	7·2	7·15	35·05
	„	12½ p.m.	9¼ miles N.E. by N.		7·5	7·25	35·05
	„	1½ „	18¾ „		7·7	7·25	35·05
	„	2½ „	28½ „		7·7	7·25	35·05
Sc. 3	„	4 „	59 10 N.	1 27 W.	7·0	7·25	35·07
	„	5 „	9½ miles N.E. by N.		7·1	7·35	35·19
Sc. 4	„	6½ „	59 26 N.	1 20 W.	7·3	7·25	35·30
	„	8 „	9½ miles N.E. by N.		7·4	7·15	35·28
Sc. 23	29 Jan.	4½ „	59 31 N.	0 37 E.	5·0	6·75	35·30
	„	6 „	9 miles W.N.W.		5·2	6·75	35·28
	„	7 „	17 „		5·4	6·85	35·30
	„	8 „	25½ „		5·6	6·55	35·30
Sc. 5	4 Feb.	6½ „	59 40 N.	1 14 W.	4·1	6·35	35·30
	„	8 „	9 miles S.E. by E. ¼ E.		3·7	6·45	35·30
Sc. 22	„	9 „	59 36 N.	0 41 W.	3·5	6·55	35·30
	„	10½ „	9 miles S. by E. ¼ E.		3·7	6·55	35·30
	„	11½ „	18 „		4·0	6·55	35·30
	5 Feb.	12½ a.m.	27 „		4·2	6·55	35·28
	„	1½ „	37 „		4·5	6·55	35·28
Sc. 24	„	3 „	58 55 N.	0 04 E.	4·6	6·55	35·28
	„	4 „	9 miles S.W. ¾ S.		4·9	6·85	35·28
	„	5 „	17½ „		4·8	6·65	35·28
	„	6 „	28 „		4·8	6·85	35·25
	„	7 „	37 „		4·5	6·65	35·21
Sc. 25	„	9 „	58 11 N.	0 32 W.	4·7	6·65	35·19
	„	10 „	8½ miles S.W. ¼ W.		4·0	6·55	35·16
	„	11 „	17¼ „		3·4	6·35	35·12
	„	12 noon	25¼ „		3·5	6·05	35·05
	„	1 p.m	33 „		3·6	6·05	34·99
Sc. 27	„	2 „	57 30 N.	1 19 W.	4·2	6·15	34·96

SURFACE OBSERVATIONS, APRIL 1906.

Station.	Date.	Hour.	Latitude.	Longitude.	Air Temp. °C.	Water Temp. °C.	S.°/₀₀
Sc. 26	6 April	7 p.m.	58 09 N.	1 50 W.	6·4	5·85	35·12
	„	9 „	9 miles N.N.E.		6·3	5·85	35·21
	„	10 „	18 „		6·0	5·85	35·28
Sc. 2	„	11 „	58 36 N.	1 46 W.	6·5	6·05	35·32
	7 April	12½ a.m.	8¼ miles N.E. by N.		7·1	5·95	35·32
	„	1½ „	16¾ „ „		7·9	5·85	35·34
	„	2½ „	25¼ „ „		7·1	6·25	35·32
Sc. 3	„	4 „	59 10 N.	1 27 W.	6·9	6·55	35·32
	„	5½ „	9¼ miles N.E. by N. ¼ N.		7·3	6·05	35·34
Sc. 4	„	6½ „	59 26 N.	1 20 W.	7·4	6·25	35·32
	„	8 „	8½ miles N.E. by N. ¼ N.		7·4	6·05	35·32
Sc. 5	„	9½ „	59 40 N.	1 14 W.	7·2	6·05	35·32
	„	11 „	9 miles S.E. by E. ½ E.		7·0	6·05	35·30
Sc. 22	„	12½ p.m.	59 36 N.	0 41 W.	7·1	6·05	35·26
	„	2 „	9½ miles N. by E.		7·0	6·05	35·30
	„	3 „	17½ „		7·0	6·15	35·30
	„	4 „	26 „		7·5	6·25	35·32
Sc. 5*a*	„	5 „	60 05 N.	0 48 W.	7·3	6·35	35·32
Sc. 5*b*	10 April	11½ a.m.	60 34 N.	0 29 W.	7·5	7·25	35·32
	11 April	9½ „	Muckle Flugga S. by E. ½ E. ½ mile.		8·1	7·05	35·32
	„	10½ „	Muckle Flugga S. by E. ½ E. 8 miles.		7·8	7·65	35·32

SURFACE OBSERVATIONS, APRIL 1906—*continued.*

Station.	Time.		Locality.		Air.	Water.	
	Date.	Hour.	Latitude.	Longitude.	Temp. °C.	Temp. °C.	S.°/oo
			° ′	° ′			
Sc. 12	14 April	11½ a.m.	61 02 N.	1 10 W.	7·9	7·75	35·32
	„	1 p.m.	9 miles N. by W. ¼ W.		8·1	7·85	35·32
	„	2 „	19½ „ „		8·3	7·95	35·30
	„	3 „	27 „ „		7·8	8·15	35·32
	„	4 „	36 „ „		7·8	7·35	35·32
Sc. 11	„	5½ „	61 42 N.	2 00 W.	8·1	7·65	35·32
	„	11 „	9½ miles E.S.E.		8·1	7·55	35·34
	„	12 „	18½ „		8·0	7·65	35·32
	12 April	1 a.m.	27½ „		7·5	7·65	35·32
Sc. 11	12 April	2½ „	61 38 N.	0 41 W.	7·3	7·55	35·30
	„	4½ „	9½ miles E. by S. ¾ S.		7·2	7·35	35·30
	„	5½ „	18 „ „		7·5	7·35	35·28
	„	6½ „	27 „ „		7·8	7·35	35·26
	„	7½ „	37 „ „		7·9	7·55	35·28
Sc. 10	„	8½ „	61 35 N.	0 47 E.	7·8	7·45	35·28
	„	10 „	9½ miles E. by S. ¾ S.		6·8	7·45	35·28
	„	11 „	18½ „ „		7·0	7·45	35·26
	„	12 „	27 „ „		7·8	7·25	35·23
Sc. 9	„	2 p.m.	61 34 N.	2 04 E.	8·1	7·05	35·19
	„	5 „	12 miles E.S.E.		7·5	5·35	34·29
Sc. 8	„	7 „	61 30 N.	3 03 E.	7·4	5·25	34·18
	„	9½ „	12½ miles S.W. by W. ¾ W.		8·1	6·85	35·23
	„	11 „	25 „ „		7·1	6·95	35·30
Sc. 7	13 April	1 a.m.	61 06 N.	2 01 E.	7·4	6·65	35·32
	„	3 „	13 miles S. by E. ½ E.		7·3	6·65	35·30
Sc. 7*a*	„	4½ „	60 45 N.	2 30 E.	7·5	6·75	35·32
	„	6½ „	13 miles W. by S.		7·0	6·55	35·32
Sc. 7*b*	„	8½ „	60 35 N.	1 50 E.	7·5	6·65	35·32
	„	9½ „	9 miles W. ¾ N.		7·4	6·75	35·34
Sc. 7*c*	„	11 „	60 34 N.	1 15 E.	7·9	7·05	35·32
	„	12½ p.m.	9 miles W.N.W.		8·2	7·15	35·32
Sc. 6	„	2 „	60 37 N.	0 29 E.	8·4	7·35	35·32
	„	4 „	9½ miles S. by W.		8·2	7·35	35·30
	„	5 „	23 „ „		8·0	6·85	35·32
Sc. 6*a*	„	6 „	60 05 N.	0 33 E.	6·9	6·75	35·32
	„	8 „	11½ miles S. by W.		6·8	6·35	35·30
	„	9 „	24½ „ „		6·8	6·35	35·30
Sc. 23	„	10½ „	59 31 N.	0 37 E.	6·7	6·25	35·28
	14 April	12½ a.m.	14½ miles S.W. ½ S.		6·9	6·15	35·28
Sc. 24	„	4 „	58 55 N.	0 04 E.	6·9	6·15	35·28
	„	6 „	22 miles S.W. ½ S.		6·9	6·15	35·30
	„	8 „	34½ „ „		5·4	6·25	35·28
Sc. 25	„	10 „	58 11 N.	0 32 W.	5·4	6·45	35·28
	„	12 „	9 miles S.W. ¼ W.		6·5	6·35	35·28
	„	1 p.m.	18¼ „ „		6·8	6·35	35·25
	„	2 „	27¼ „ „		7·2	6·45	35·23
	„	3 „	35¾ „ „		7·4	6·05	34·99
Sc. 27	„	4 „	Buchau Deep		7·3	5·75	34·96
	„	5 „	9 miles S.W. by W. ½ W.		7·4	5·65	34·76
	„	6 „	18½ „ „		7·5	5·55	34·61

SURFACE OBSERVATIONS, JUNE 1906.

Station.	Date.	Hour.	Latitude.	Longitude.	Air Temp. °C.	Water Temp. °C.	S.°/oo
Sc. 26	12 June	12 a.m.	58 09	1 50 W.	11·2	9·85	35·23
	„	1½ „	9½ miles N.E. by E. ½ N.		11·2	10·05	35·23
	„	2½ „	18½ „ „		11·3	11·05	35·25
Sc. 2	„	4 „	58 36 N.	1 46 W.	11·8	10·35	35·25
	„	5 „	8¾ miles N.E. by N. ½ N.		11·2	10·55	35·25
	„	6 „	16½ „ „		10·2	9·95	35·25
	„	7 „	24½ „ „		10·1	9·45	35·26
Sc. 3	„	8 „	59 10	1 27 W.	10·2	8·45	35·26
	„	9 „	9½ miles N.E. by N. ½ N.		10·8	8·25	35·26

Surface Observations, June 1906—*continued.*

Station.	Time.		Locality.		Air.	Water.	
	Date.	Hour.	Latitude.	Longitude.	Temp. °C.	Temp. °C.	S.°/₀₀
			° ′	° ′			
Sc. 4	12 June	11½ a.m.	59 26 N.	1 20 W.	10·9	8·85	35·26
	„	1½ p.m.	9 miles N.E. by N. ½ N.		10·0	8·55	35·26
Sc. 5	„	3½ „	59 40	1 14 W.	9·5	7·95	35·26
Sc. 5*a*	13 June	3 „	60 05	0 48 W.	10·1	9·15	35·26
	„	4½ „	8¾ miles N.E. by N. ½ N.		9·9	8·75	35·25
	„	5½ „	18½ „	„	10·1	8·15	35·26
Sc. 5*b*	„	7 „	60 31 N.	0 35 W.	10·0	8·85	35·26
Sc. 12	14 June	6 „	61 02 N.	1 10 W.	9·8	9·55	35·26
	„	7½ „	9 miles N.W.		9·6	9·55	35·26
	„	8½ „	18 „		9·4	9·25	35·30
	„	9½ „	27 „		9·8	9·45	35·28
Sc. 13*a*	„	11½ „	61 16 N.	2 08 W.	9·4	8·85	35·26
	15 June	3 a.m.	9 miles N.W. by W. ¾ W.		9·2	8·85	35·26
	„	4 „	19½ „	„	8·9	8·55	35·26
Sc. 14*a*	„	5 „	61 18	2 59 W.	8·7	8·75	35·26
	„	10 „	9 miles N.W. ¼ W.		10·1	9·35	35·30
Sc. 15*a*	„	11½ „	61 27	3 42 W.	9·9	8·55	35·19
	„	5½ p.m.	9½ miles N.W. ¼ W.		9·5	9·25	35·23
	„	6½ „	19 „	„	9·7	9·45	35·23
	„	7½ „	28 „	„	8·5	8·75	35·21
Sc. 15*b*	„	10½ „	61 39 N.	4 45 W.	8·6	8·75	35·26
	16 June	2 a.m.	9 miles N.W. ¼ W.		9·0	8·65	35·23
Sc. 16*a*	„	5½ „	61 49 N.	5 36 W.	9·7	8·75	35·19
	„	6½ „	9 miles N.W. ¾ N.		9·3	8·55	35·21
	„	7½ „	18½ „	„	9·3	8·65	35·23
Sc. 16	„	8½ „	62 00 N.	6 12 W.	9·2	8·45	35·19
		10 „	9 miles W. by N.		9·2	7·25	35·19
Sc. 17	18 June	12½ p.m.	61 11 N.	6 33 W.	11·1	7·55	35·21
	„	1½ „	9 miles S.E. ¾ S.		12·4	8·95	35·21
	„	2½ „	18½ „	„	12·2	9·55	35·23
Sc. 18*a*	„	3½ „	60 57 N.	5 47 W.	12·0	10·05	35·30
	„	7 „	9 miles S.E. ¾ S.		10·2	10·05	35·30
	„	8 „	18¼ „	„	10·7	10·25	35·30
	„	9 „	27½ „	„	10·6	10·05	35·30
Sc. 19*a*	„	11 „	60 40 N.	4 50 W.	10·0	10·05	35·30
	19 June	3 a.m.	9 miles S.E. ½ S.		10·8	10.45	35·35
	„	4 „	18½ „	„	10·8	10·45	35·39
Sc. 19*b*	„	6 „	60 26 N.	4 02 W.	11·3	10·75	35·37
	„	8 „	9¼ miles S.E. by S.		11·4	10·55	35·37
Sc. 20*a*	„	9 „	60 17 N.	3 36 W.	12·0	11·05	35·34
	„	10½ „	9½ miles S. by E. ½ E.		12·8	11·35	35·34
Sc. 21*a*	„	Noon	60 02 N.	3 13 W.	14·1	11·65	35·32
	„	3½ p.m.	19 miles S.E. by E. ¼ E.		14·7	12·05	35·28
Sc. 21	„	5 „	59 46 N.	2 21 W.	14·6	11·75	35·30
	„	6 „	9 miles S.E. by E. ¼ E.		13·5	11·95	25·28
	„	7 „	18¼ „	„	13·5	12·45	35·28
	„	8 „	27½ „	„	11·4	10·35	35·26
	„	9 „	37 „	„	11·5	10·95	35·25
	„	10 „	47 „	„	11·2	11·05	35·26
Sc. 22	„	11½ „	59 36 N.	0 41 W.	11·4	11·05	35·26
	20 June	1 a.m.	9½ miles S.E. by E. ¾ E.		11·7	11·15	35·25
	„	2 „	18½ „	„	11·4	11·15	35·21
	„	3 „	29 „	„	11·3	11·25	35·16
Sc. 23	„	5 „	59 31 N.	0 37 E.	11·0	11·95	35·16
	„	7½ „	9½ miles S.W. ¼ S.		12·0	11·75	35·16
	„	8½ „	19 „	„	12·7	12·05	35·16
	„	9½ „	29 „	„	14·7	12·15	35·17
Sc. 24	„	11½ „	58 55 N.	1 30 W.	14·8	11·65	35·17
	„	4 p.m.	9 miles S.W. ½ S.		14·6	12·75	35·17
	„	5 „	18¼ „	„	14·2	12·35	35·19
	„	6 „	27½ „	„	13·4	12·15	35·19
	„	7 „	36¾ „	„	13·8	12·05	35·19
Sc. 25	„	8½ „	58 11 N.	0 32 W.	13·6	11·45	35·21
	„	10 „	8½ miles S.W. ½ W.		13·1	11·25	35·21
	„	11 „	17 „	„	13·4	10·65	35·23
	21 June	12½ a.m.	25½ „	„	14·0	10·55	35·21
	„	1 „	34 „	„	11·2	10·55	35·19
Sc. 27	„	2 „	57 30 N.	1 19 W.	12·0	10·35	35·19

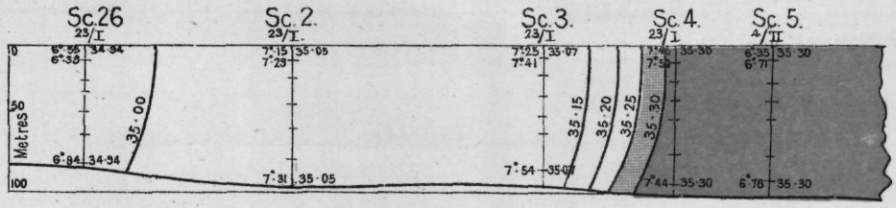
Surface Observations, August—September 1906.

Station.	Time.		Locality.		Air.	Water.	
	Date.	Hour.	Latitude.	Longitude.	Temp. °C.	Temp. °C.	S.‰
			° ′	° ′			
	7 Sept.	5 p.m.	18 miles S. by E. ½ E.		12·9	11·65	35·27
	"	6 "	26½ "	"	12·8	11·85	35·26
	"	7 "	35½ "	"	12·8	11·15	35·24
	"	8 "	44½ "	"	12·6	11·15	35·24
	"	9 "	53½ "	"	13·1	11·45	35·22
	"	10 "	62½ "	"	13·4	12·25	35·20
Sc. 24	"	11 a.m.	58 55	0 04 E.	13·4	12·05	35·18
	8 Sept.	1 "	9 miles S.W. ¼ S.		13·3	12·15	35·18
Sc. 25	"	6 "	58 11 N.	0 32 W.	12·8	11·85	35·17
	"	7½ "	9 miles S.W. ¼ S.		12·8	12·15	35·15
	"	8½ "	18 "	"	13·0	11·95	35·09
	"	9½ "	28 "	"	14·2	11·95	35·06
	"	10½ "	37 "	"	13·8	12·05	35·02
Sc. 27	"	noon	57 30	1 19 W.	13·8	12·05	35·00
	2 Sept.	10 a.m.	6½ miles E. by S. ½ S.		12·2	11·25	35·26
	"	11 "	13½	"	12·5	11·15	35·27
	"	12 "	20	"	12·7	11·25	35·26
	"	1 p.m.	26	"	12·2	11·35	35·26
Sc. 10	3 Sept.	1 "	61 35 N.	0 47 E.	14·1	11·85	35·26
	"	4½ "	8½ miles E. by S. ¾ S.		13·0	11·55	35·26
	"	5½ "	17	"	13·3	11·45	35·26
	"	6½ "	26	"	12·8	11·45	35·26
Sc. 9	"	7½ "	61 34 N.	2 04 E.	12·2	11·65	34·73
	"	11 "	8½ miles E. by S. ¾ S.		13·0	12·25	33·37
	"	12 "	17	"	12·3	12·15	33·60
	4 Sept.	1 a.m.	26	"	12·4	12·95	31·89
Sc. 8	"	3 "	61 30 N.	3 03 E.	13·0	12·35	31·35
	"	6½ "	18 miles S.W. by W. ¾ W.		12·0	12·75	31·55
	"	7½ "	27	"	12·2	11·85	34·63
	"	8½ "	35½	"	12·1	11·85	34·81
	"	9½ "	44	"	13·0	12·25	34·98
Sc. 7	"	10½ "	61 06 N.	2 01 E.	13·0	12·25	35·15
	"	2 p.m.	9 miles S.E. by S. ¾ S.		13·0	12·35	35·11
Sc. 7*a*	"	5 "	60 45 N.	2 30 E.	12·2	12·35	35·09
	"	7 "	9 miles W. by N.		12·1	12·55	35·17
	"	8 "	18	"	12·5	12·55	35·15
Sc. 7*b*	"	9 "	60 35 N.	1 50 F.	13·0	12·55	35·08
Sc. 7*e*	5 Sept.	1 am.	60 34 N.	1 15 E.	13·0	12·45	35·15
Sc. 6	"	4 "	60 37 N.	0 29 E.	12·2	12·05	35·18
Sc. 6*a*	"	10½ "	59 57 N.	0 33 E.	13·1	12·63	35·20
	"	noon	8½ miles S.S.W.		13·3	12·65	35·22
	"	1 p.m.	16½	"	13·3	12·65	35·20
Sc. 23	"	2½ "	59 31 N.	0 37 E.	13·6	12·95	35·18
	7 Sept.	4 "	9 miles S. by E. ½ E. from Sumburgh Head.		13·1	11·65	35·29
Sc. 15*a*	25 Aug.	6 a.m.	61 27 N.	3 42 W.	10·1	9·65	35·18
	"	9 "	8½ miles N.W.		10·2	9·55	35·18
	"	10 "	17½ "	"	10·5	9·35	35·18
	"	11 "	26 "	"	10·6	9·75	35·18
Sc. 15*b*	"	Noon	61 39 N.	4 45 W.	10·6	9·75	35·18
	"	3½ p.m.	8½ miles N.W.		11·0	9·85	35·20
Sc. 16*a*	"	5 "	61 49 N.	5 36 W.	10·5	9·65	35·18
	"	7 "	9 miles N.W. ¾ W.		10·0	9·55	35·20
Sc. 16	"	8½ "	62 00 N.	6 12 W.	11·3	8·95	35·17
	27 Aug.	7 "	5 miles S. ¾ E. from Munken Reef.		10·4	9·45	35·18
Sc. 17	"	8 "	61 11 N.	6 33 W.	10·6	9·85	35·18
	"	11 "	8½ miles S.E. ¾ E.		12·0	9·85	35·17
	"	12 "	17 "	"	11·7	10·05	35·20
Sc. 18*a*	28 Aug.	1½ a.m.	60 57 N.	5 47 W.	11·5	10·15	35·18
Sc. 19*a*	"	8 "	60 40 N.	4 50 W.	11·0	10·75	35·18
	"	3½ p.m.	9¼ miles S.E. ½ E.		12·5	11·05	35·18
	"	4½ "	18 "	"	12·6	11·85	35·27
Sc. 19*b*	"	6 "	60 26 N.	4 02 W.	12·4	11·85	35·33
	"	10 "	12 miles S.E. by S.		11·3	11·65	35·31
Sc. 20*a*	"	10½ "	60 17 N.	3 36 W.	12·2	11·55	35·33
	29 Aug.	1 a.m.	9 miles S. by E. ½ E.		10·8	11·45	35·33
Sc. 21*a*	"	2 "	60 02 N.	3 13 W.	10·9	11·55	35·31
Sc. 21	"	7 "	59 46 N.	2 21 W.	13·0	11·05	35·20

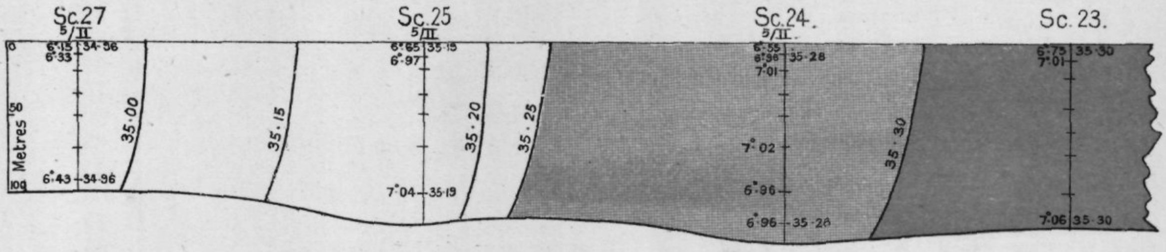
SURFACE OBSERVATIONS, AUGUST—SEPTEMBER 1906—*continued.*

Station.	Time.		Locality.		Air.	Water.	
	Date.	Hour.	Latitude.	Longitude.	Temp.° C.	Temp.° C.	S.°/oo
Sc. 12	1 Sept.	4 p.m.	61 02 N.	1 10 W.	12·2	11·75	35·33
	,,	7 ,,	9 miles N. by W. ½ W.		11·1	11·75	35·33
	,,	8 ,,	18 ,,	,,	12·2	11·55	35·29
	,,	9 ,,	27 ,,	,,	12·2	11·25	35·27
	,,	10 ,,	36 ,,	,,	12·0	11·05	35·26
Sc. 11*a*	,,	12 ,,	61 42 N.	2 00 W.	11·6	11·05	35·25
Sc. 11	2 Sept.	7 a.m.	61 38 N.	0 41 W.	11·7	11·05	35·26
Sc. 26	21 August	11½ ,,	58 09 N.	1 50 W.	13·8	11·85	35·08
	,,	12½ p.m.	8 miles N.E. by N. ½ N.		13·4	11·85	35·09
	,,	1½ ,,	18 ,,	,,	12·8	11·75	35·09
Sc. 2	,,	3 ,,	58 36 N.	1 46 W.	12·3	11·35	35·09
	,,	4 ,,	9 miles N.E. by N. ½ N.		12·5	11.35	35·13
	,,	5 ,,	18 ,,	,,	12·6	11·35	35·16
	,,	6 ,,	27 ,,	,,	12·1	11·05	35·16
Sc. 3	,,	7 ,,	59 10 N.	1 27 W.	12·1	11·25	35·24
	,,	8½ ,,	9 miles N.E. by N. ½ N.		11·8	10·65	35·24
Sc. 4	,,	10 ,,	59 26 N.	1 20 W.	11·0	10·55	35·26
	,,	11½ ,,	9 miles N.E. by N. ½ N.		10·7	10·35	35·26
Sc. 5	22 August	2 a.m.	59 40 N.	1 14 W.	11·0	11·05	35·27
	,,	3 ,,	9 miles S.E. by N. ¼ N.		11·2	12·05	35·26
	,,	4 ,,	18 ,,	,,	11·2	12·05	35·24
Sc. 22	,,	6 ,,	59 36 N.	0 41 W.	11·4	12·05	35·22
	,,	7 ,,	9½ miles N. ¾ E.		12·1	12·05	35·26
	,,	8 ,,	17½ ,,		12·1	12·15	35·27
	,,	9 ,,	27 ,,		11·3	11·65	35·27
Sc. 5A	,,	10 ,,	60 05 N.	0 48 W.	11·8	11·55	35·27
	,,	11½ ,,	9½ miles N.E. by N.		11·8	11·35	35·29
	,,	12½ p.m.	17½ ,,		11·0	11·05	35·27
Sc. 5B	,,	2 ,,	60 34 N.	0 29 W.	11·6	10·85	35·29
	24 August	noon	11 miles N. by W. from Ramma Stacks.		11·8	11·55	35·27
	,,	1 p.m.	9 miles N.W. from last position.		11·1	11·45	35·27
	,,	2 ,,	19 ,,	,,	11·2	11·35	35·29
	,,	3 ,,	27½ ,,	,,	10·8	11·45	35·31
Sc. 13A	,,	4½ ,,	61 16 N.	2 08 W.	11·0	11·65	35·33
	,,	6 ,,	8¾ miles N.W.		11·0	10·85	35·33
	,,	7 ,,	17½ ,,		10·0	10·55	35·31
Sc. 14A	,,	9 ,,	61 27 N.	3 42 W.	10·0	11·25	35·33

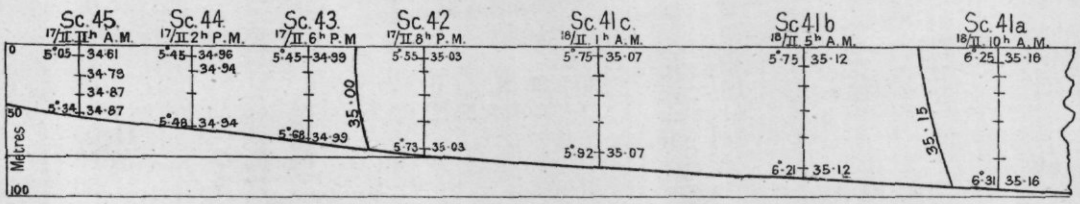
1. North Sea, Aberdeen-Shetland-Jan-Feb. 1906.



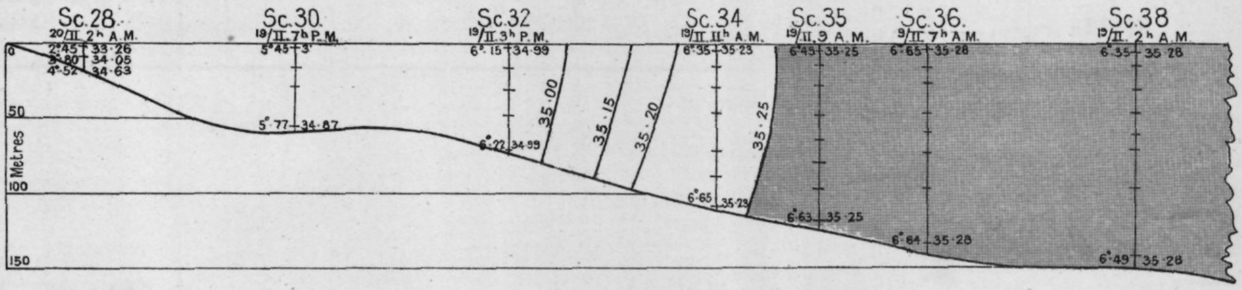
2. North Sea, North Western Area, Jan-Feb. 1906.



3. Section from Firth of Forth towards Norwegian Coast-Feb. 1906.

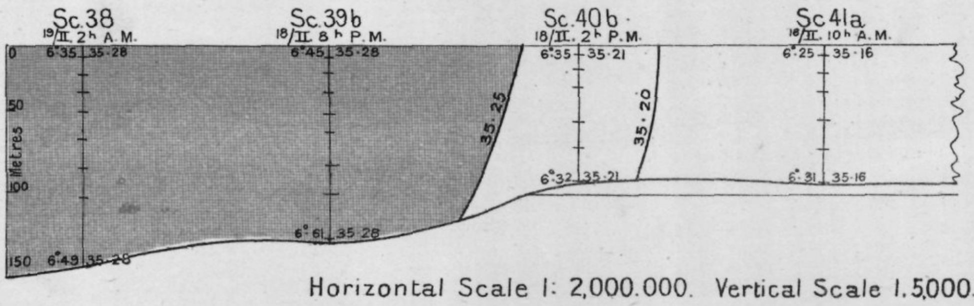


4. Section from Moray Firth towards the Norwegian Coast-Feb. 1906.



5. Section in North Sea, from North to South, about 1° E.

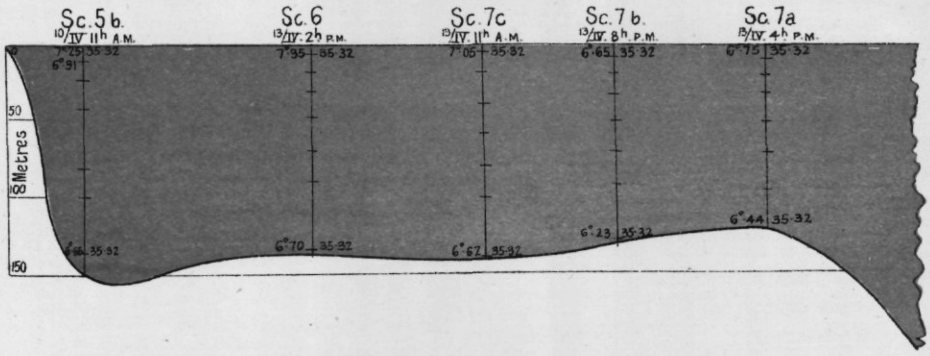
Feb. 1906.



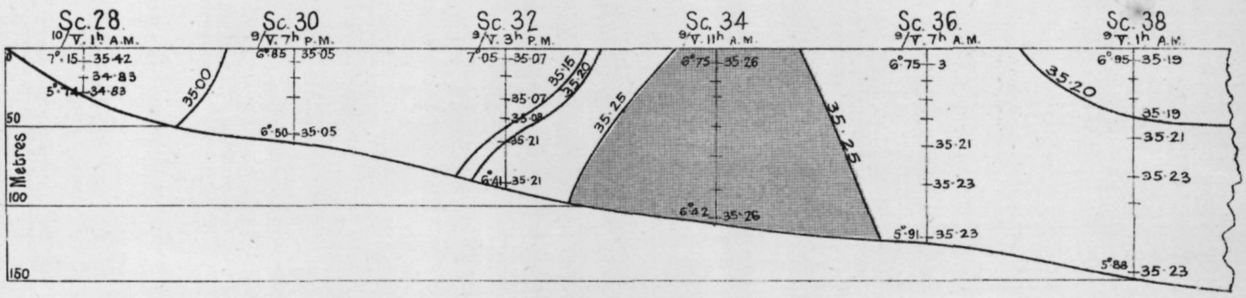
Horizontal Scale 1: 2,000.000. Vertical Scale 1.5,000.

Weller & Graham, L^td Litho. London.

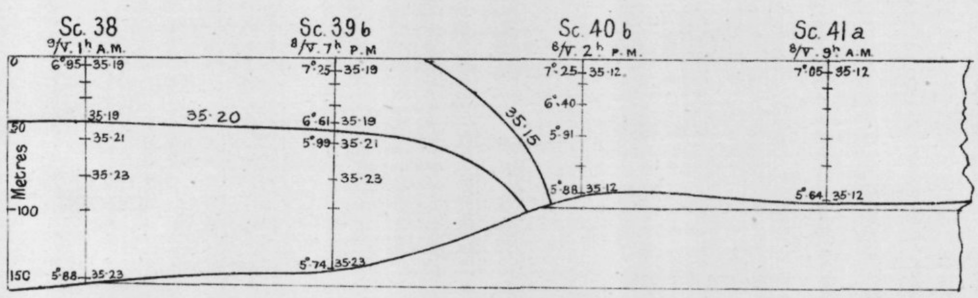
1. Section Eastwards from North of Shetland. April. 1906.



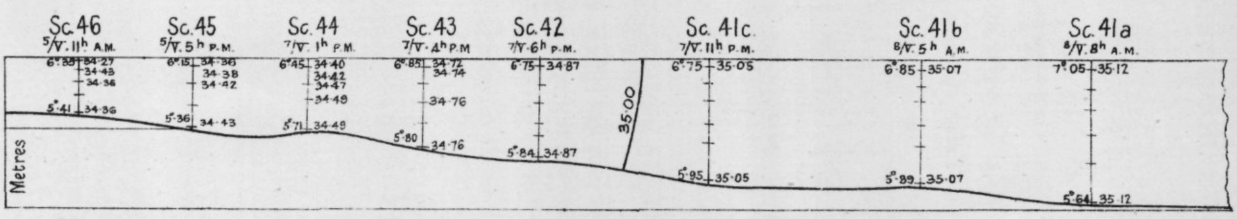
2. Section from Moray Firth towards Norwegian Coast May 1906.



3. Section in North Sea, from North to South, about 1° E. May 1906.



4. Section from Firth of Forth towards Norwegian Coast May 1906.

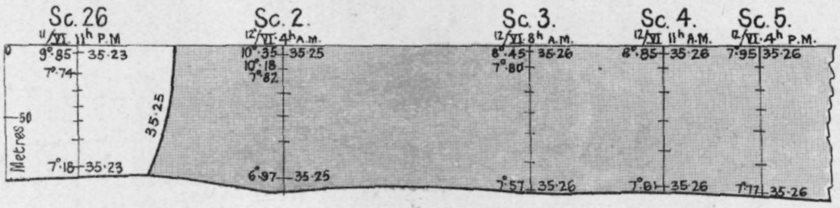


Horizontal Scale 1:2,000,000 Vertical Scale 1:5,000.

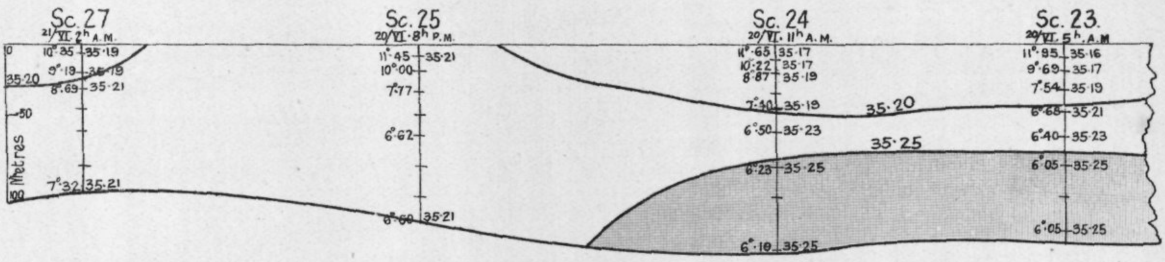
2204

Weller & Graham, Ltd Litho. London.

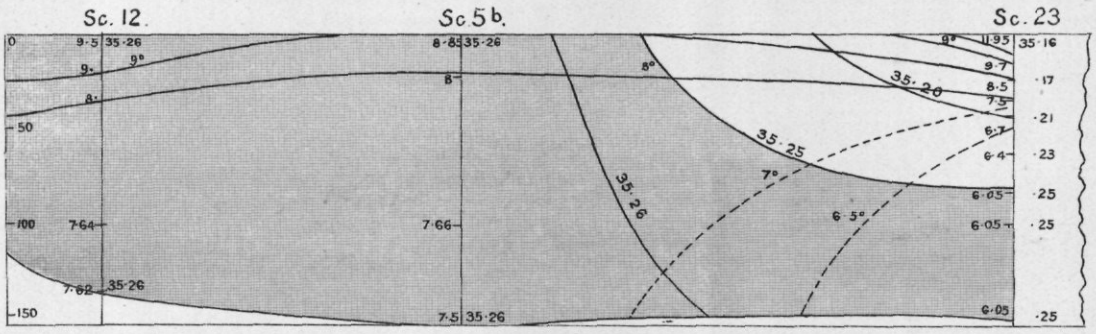
1. North Sea—between Aberdeen & Shetland. June 1906.



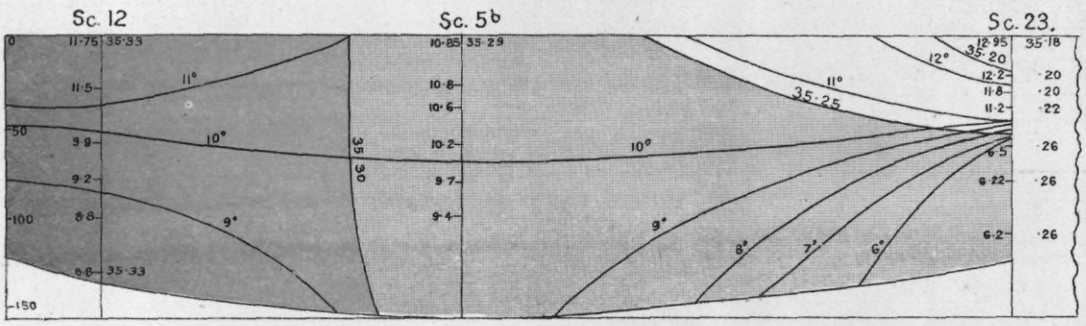
2. North Sea—North Western Area June, 1906



3. North of Shetland Southwards to Station 23. June 1906.



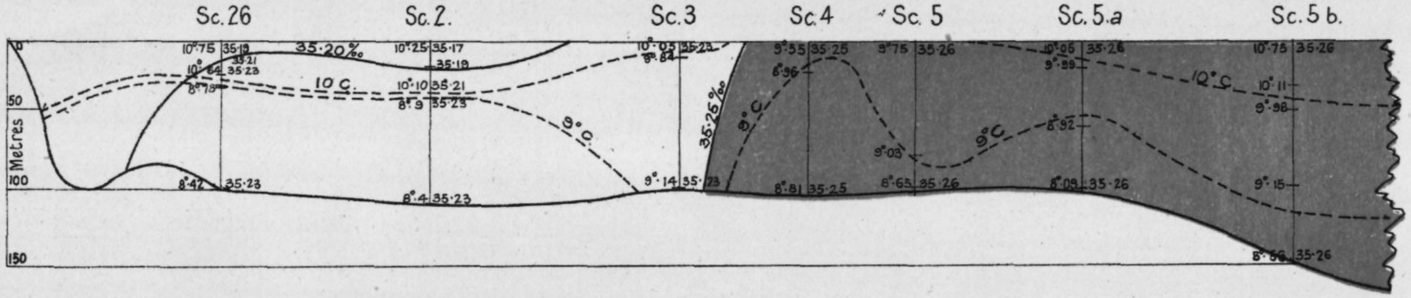
4. North of Shetland Southwards to Station 23. Aug.-Sep. 1906.



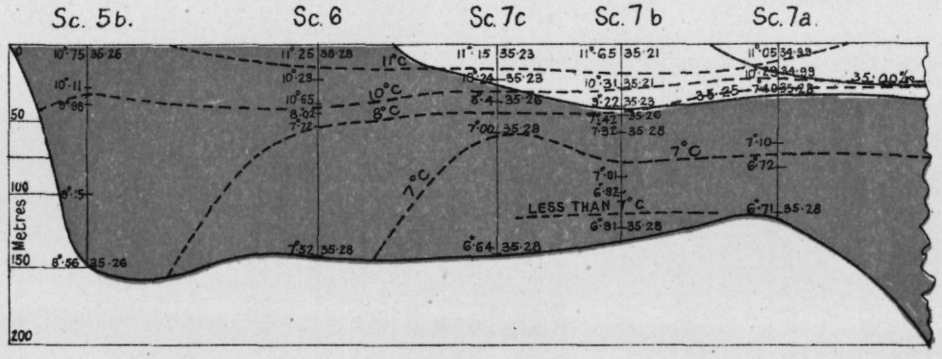
2204.

Weller & Graham, Ltd Litho. London.

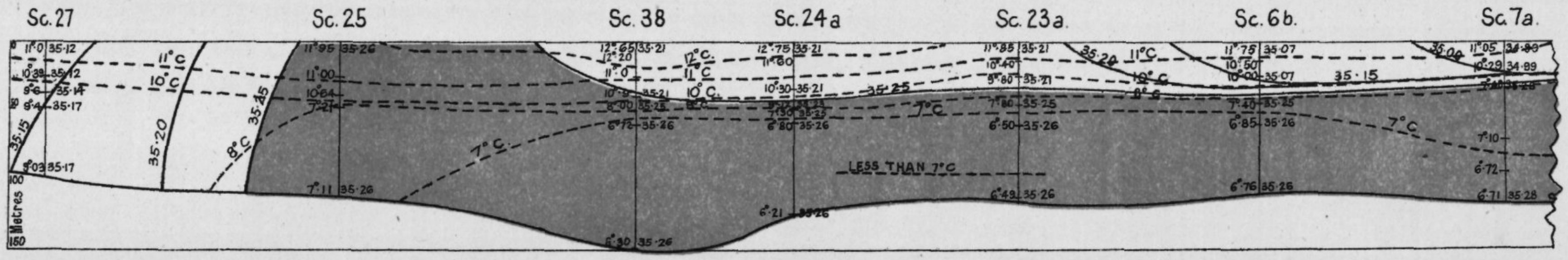
1. North Sea between Scotland and Shetland, July 1906.



2. Section from North of Shetland Eastwards, July 1906.



3. North Sea. North Western Area.

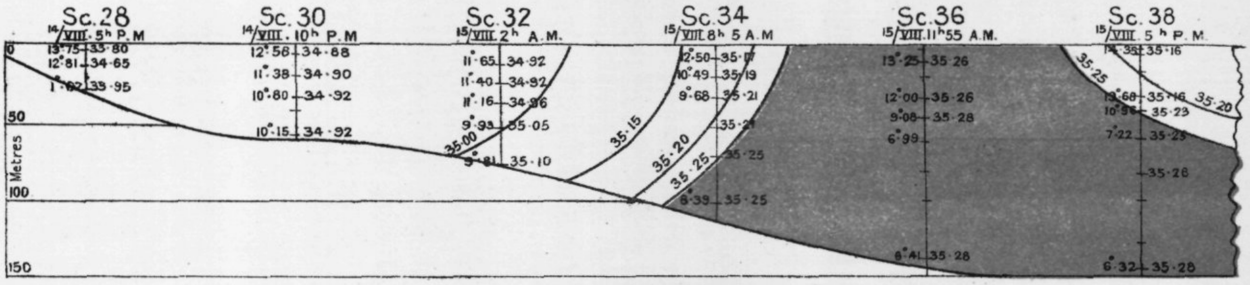


Horizontal Scale 1:2,000,000 Vertical Scale 1:5,000.

Plate IV.

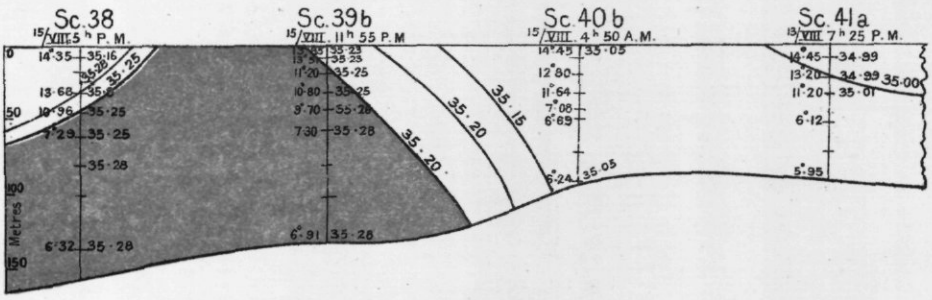
1. Section from Moray Firth towards Norwegian Coast.

August. 1906.



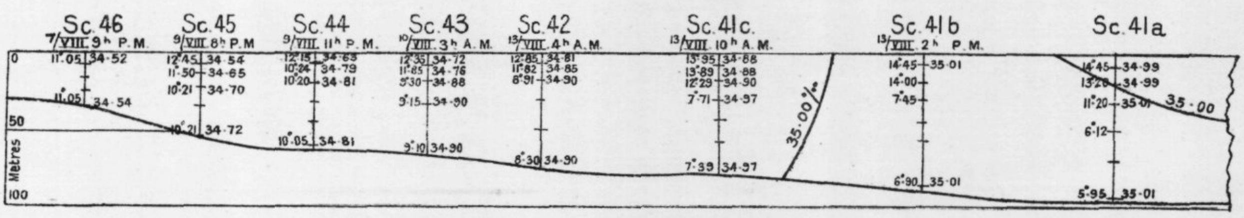
2. Section in North Sea from North to South, about 1° E.

August 1906.



3. Section from Firth of Forth towards Norwegian Coast.

August 1906.



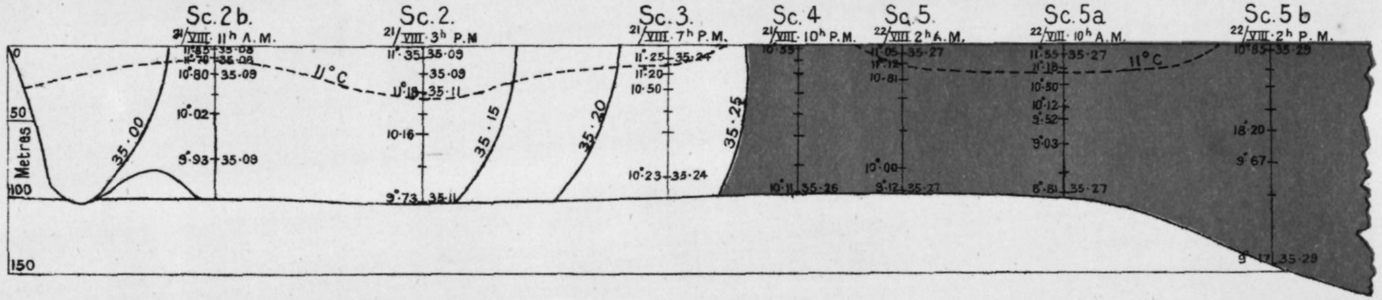
Horizontal Scale 1:2,000,000. Vertical Scale 1:5,000.

2204 9 08

Weller & Graham, Ltd Litho. London.

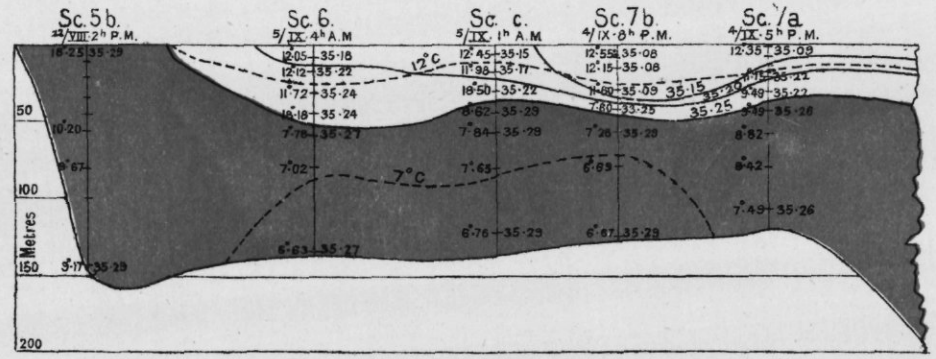
1. North Sea between Scotland & Shetland.

August 1906.



2. Section from Shetland Eastwards.

Aug.-Sept. 1906.



Horizontal Scale 1:2,000.000.
Vertical Scale 1:5,000.

3. North Sea, North-western Area.

Sept 1906.

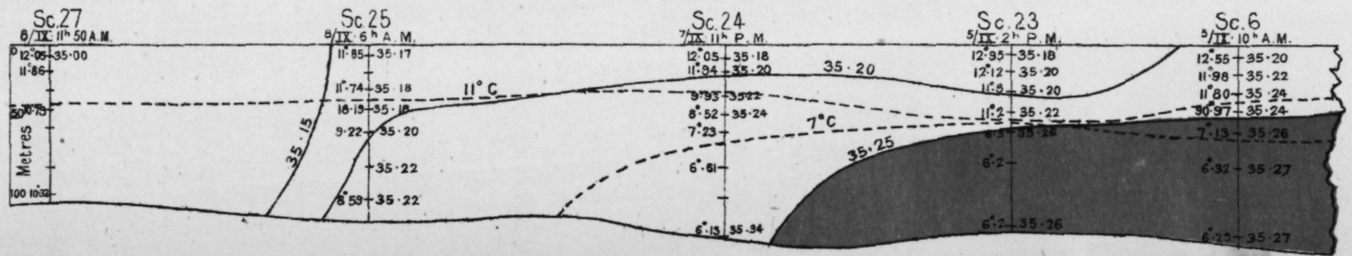
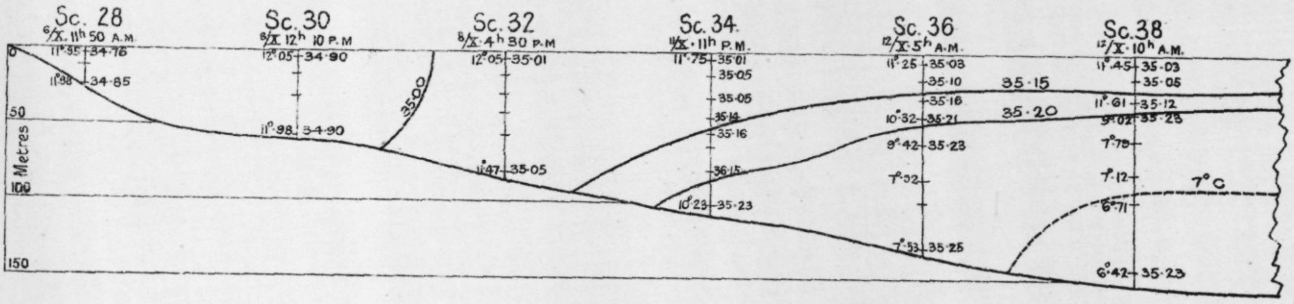


Plate VI.

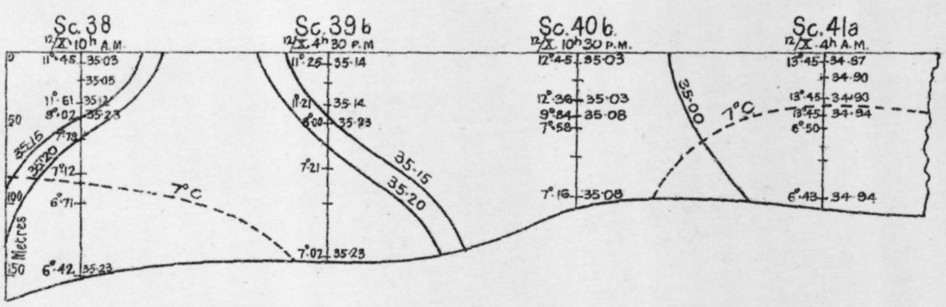
1. Section from Moray Firth towards Norway.

OCTOBER, 1906.



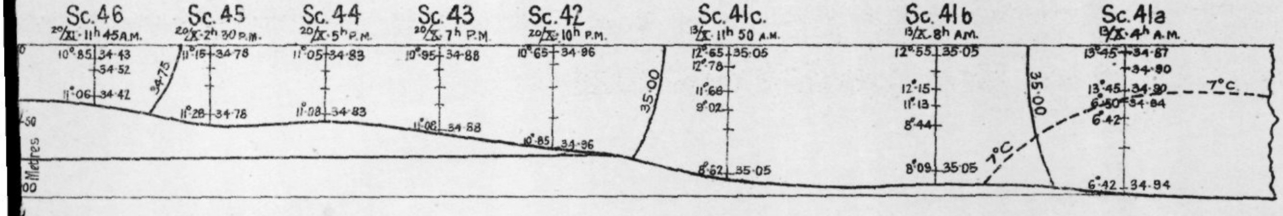
2. Section in North Sea from North to South about 1° E.

OCTOBER, 1906.



3. Section from the Firth of Forth towards Norway,

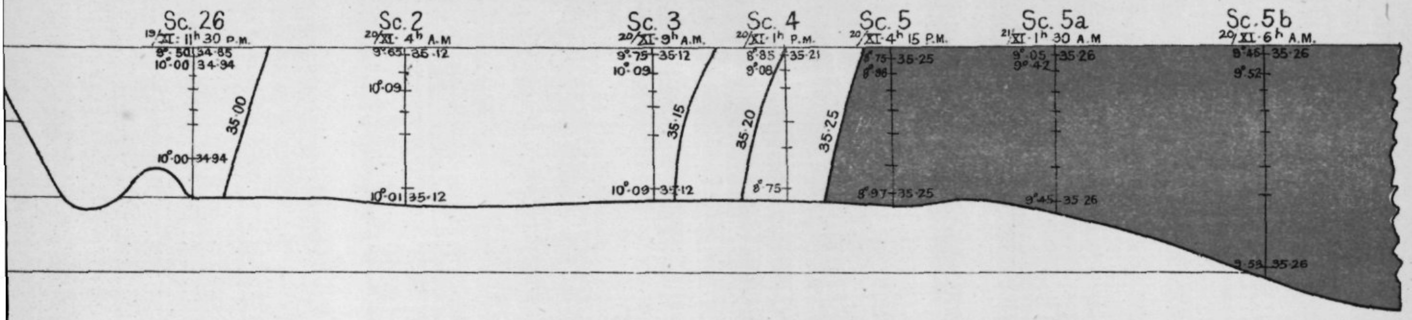
OCTOBER, 1906.



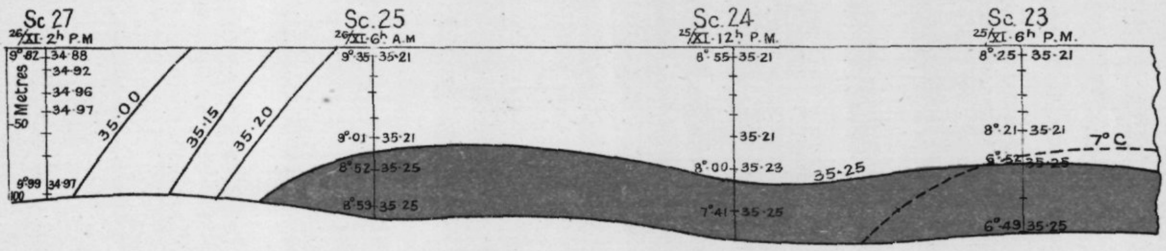
Horizontal Scale 1:2,000,000   Vertical Scale 1:5,000.

Weller & Graham, Ltd. Litho, London.

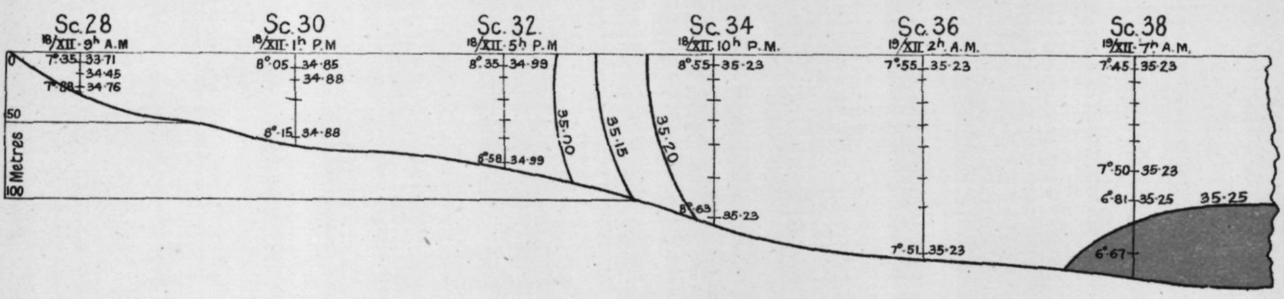
1. North Sea between Scotland & Shetland, November 1906.



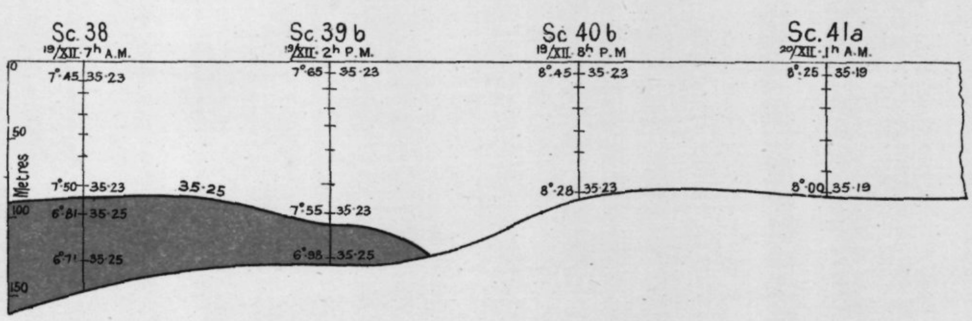
2. North Sea, North Western Area, November 1906.



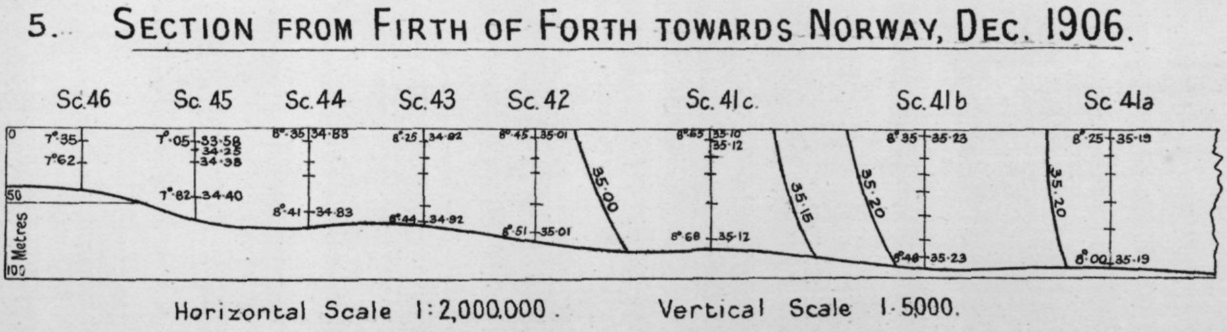
3. Section from Moray Firth towards Norway December 1906.



4. Section in North Sea, from North to South, about 1° E. December 1906.



5. Section from Firth of Forth towards Norway, Dec. 1906.

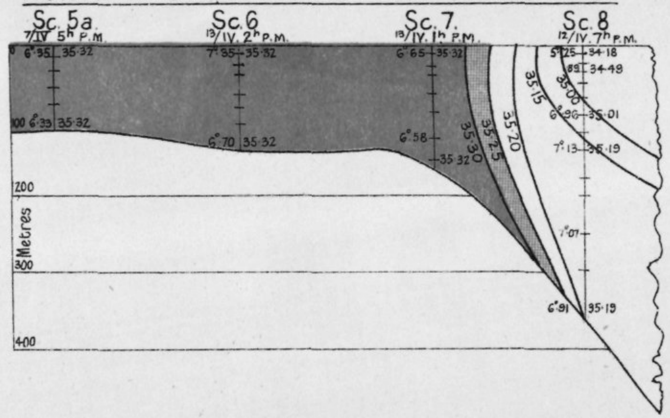


Horizontal Scale 1:2,000,000. Vertical Scale 1:5000.

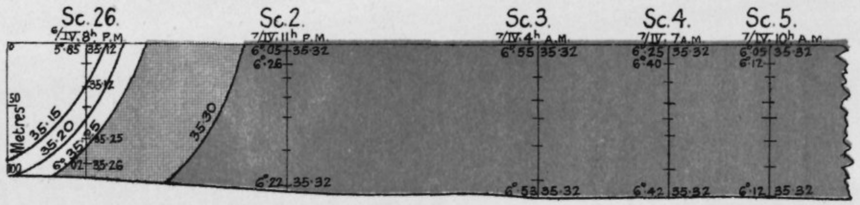
2204

Weller & Graham, Ltd Litho. London.

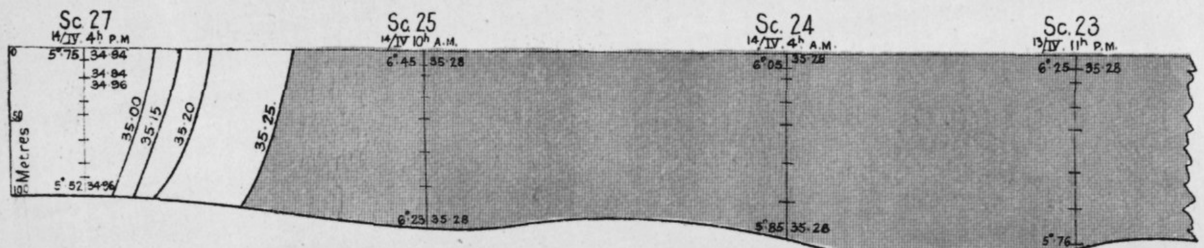
1. Section from South of Shetland in a North Easterly direction April 1906.



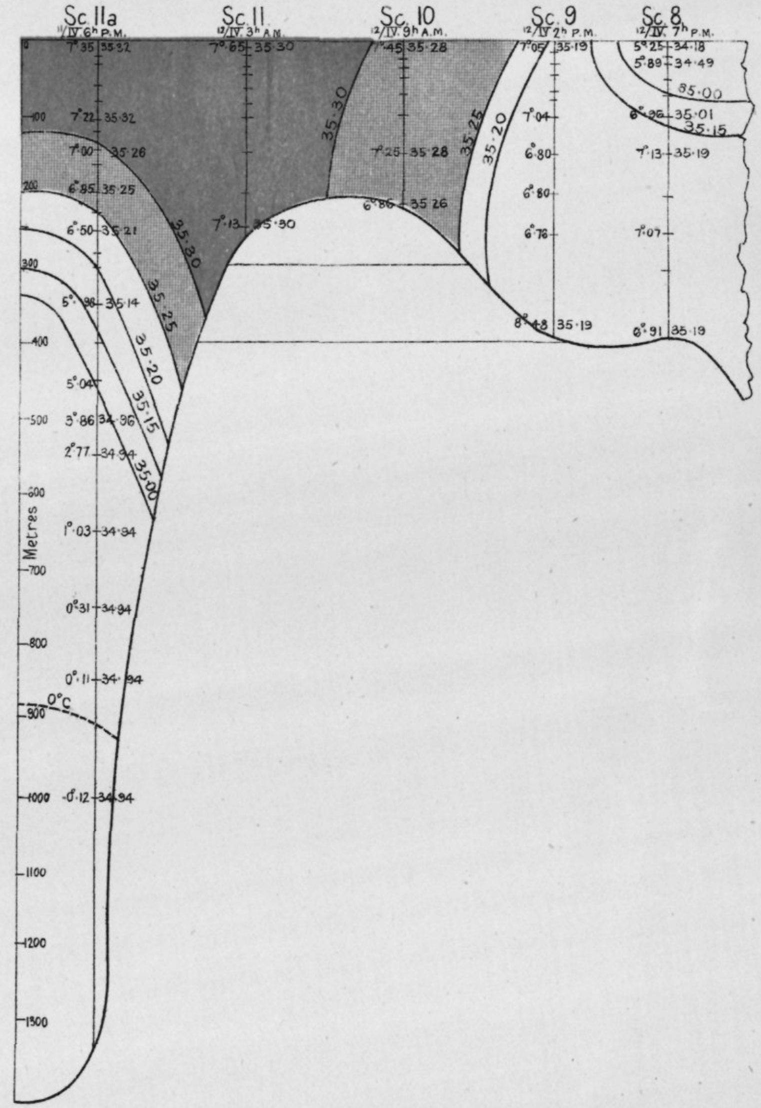
2. North Sea between Aberdeen & Shetland. April, 1906.



3. North Sea, North Western Area, April 1906



4. Entrance from North Sea to Norwegian Sea, April 1906.



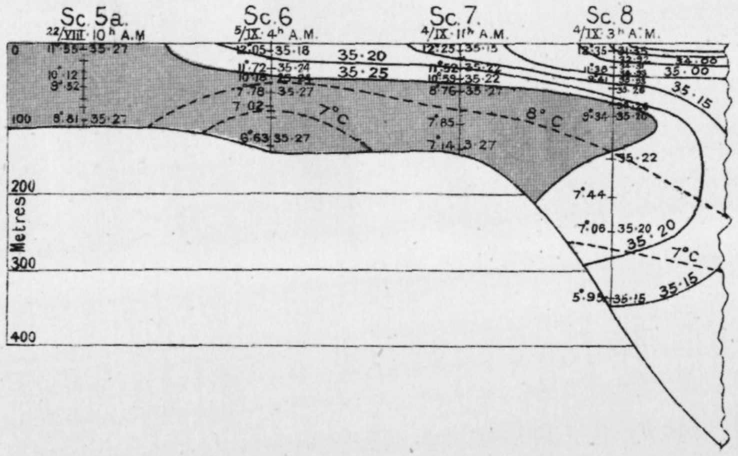
Horizontal Scale 1:2,000,000 Vertical Scale, 1:5,000

Plate IX.

North Sea between Shetland & Norway.

Aug-Sept. 1906.

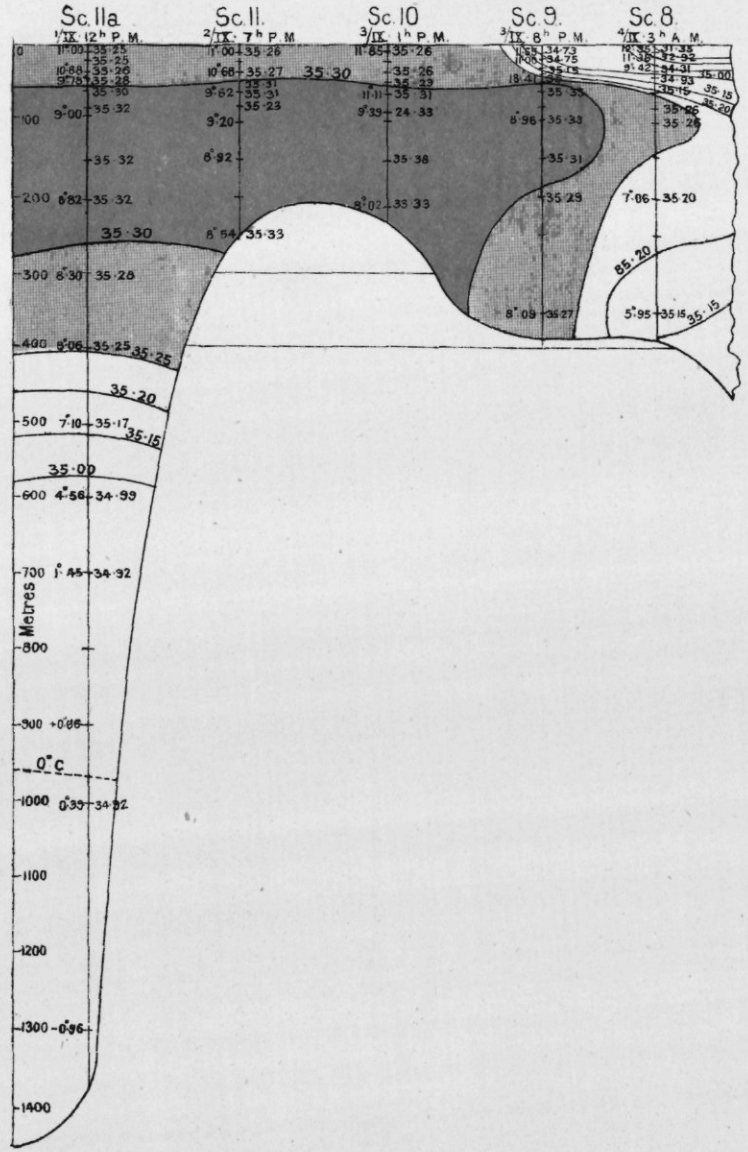
1.



Entrance from North Sea to Norwegian Sea.

Sept. 1906.

2.



Horizontal Scale 1: 2,000,000
Vertical Scale 1: 10,000.

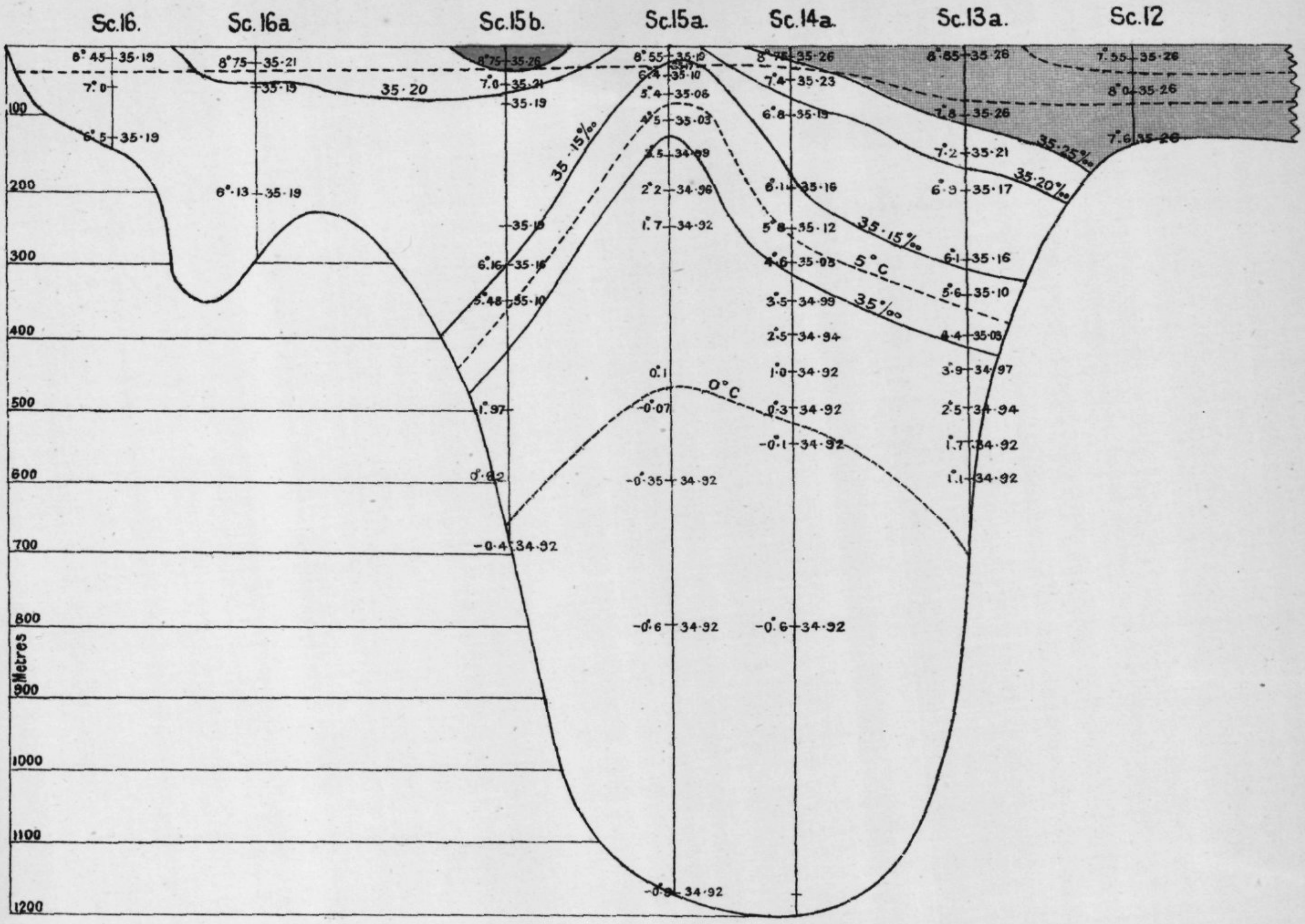
Plate X.

2204. 9. 08

1. Faeroe-Shetland Channel.

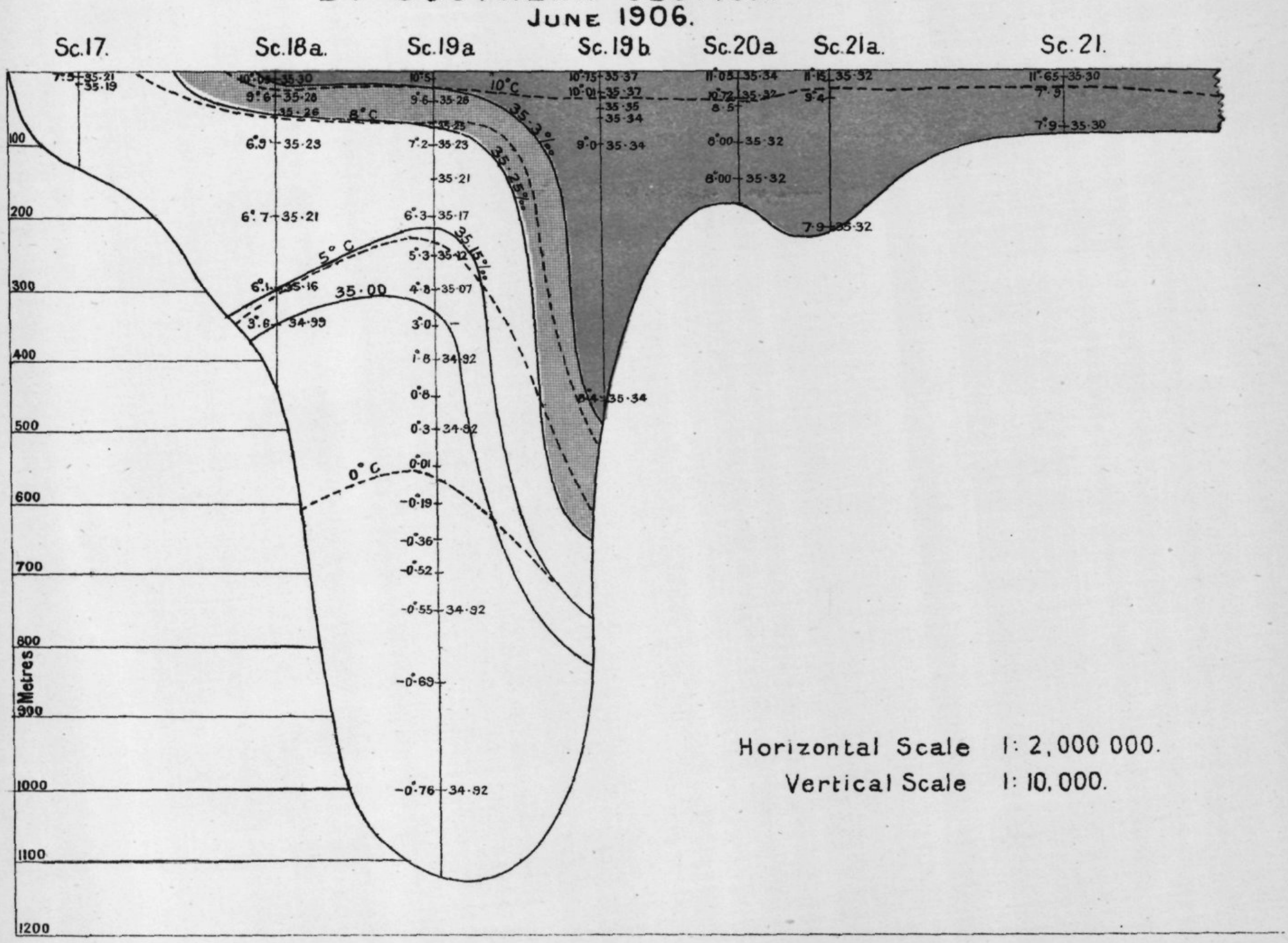
Northern Section.

June 1906.



2. Southern Section.

June 1906.



Horizontal Scale 1: 2,000 000.
Vertical Scale 1: 10,000.

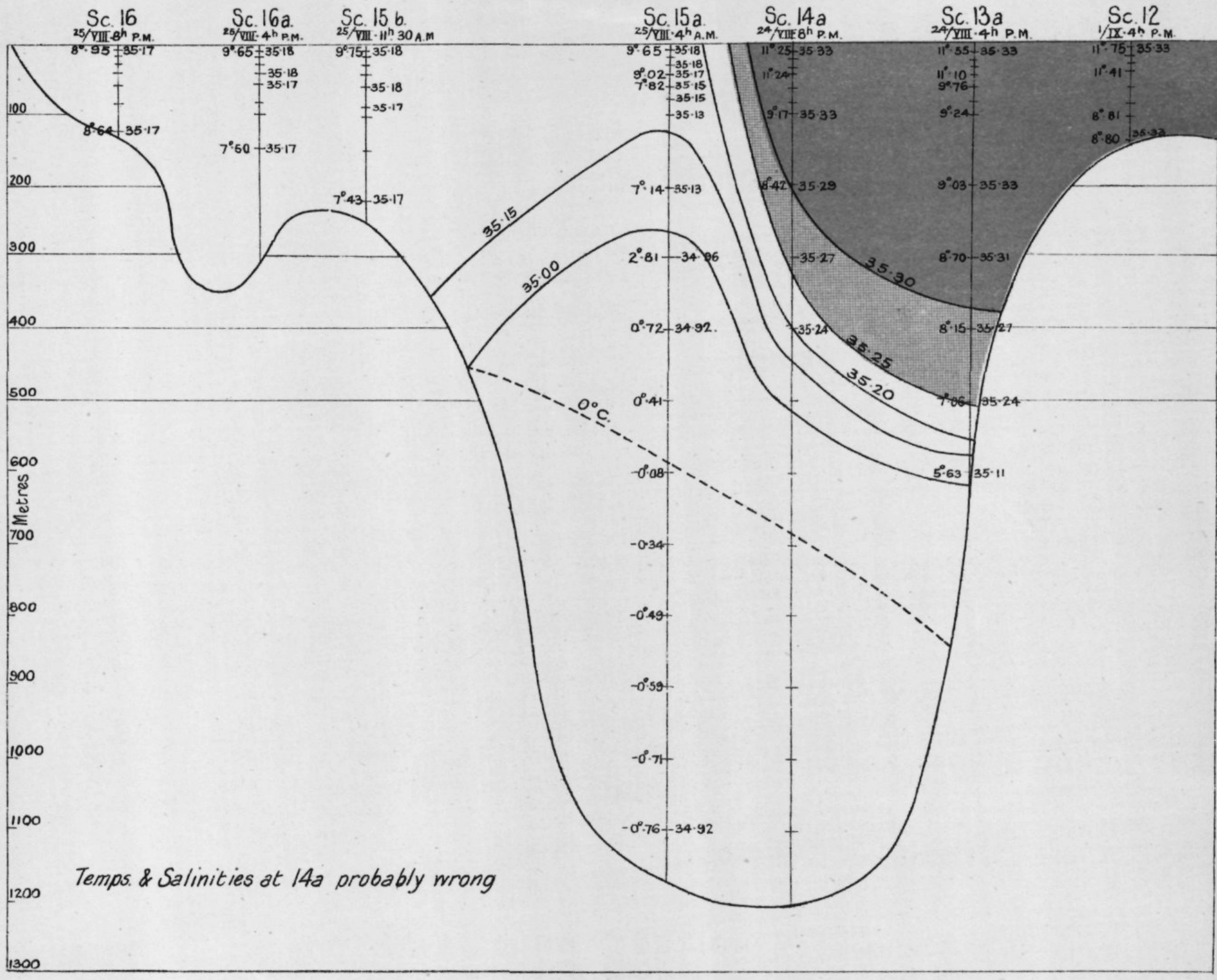
2204. 9. 08

Weller & Graham, Ltd Litho. London.

1. Faeroe _ Shetland Channel

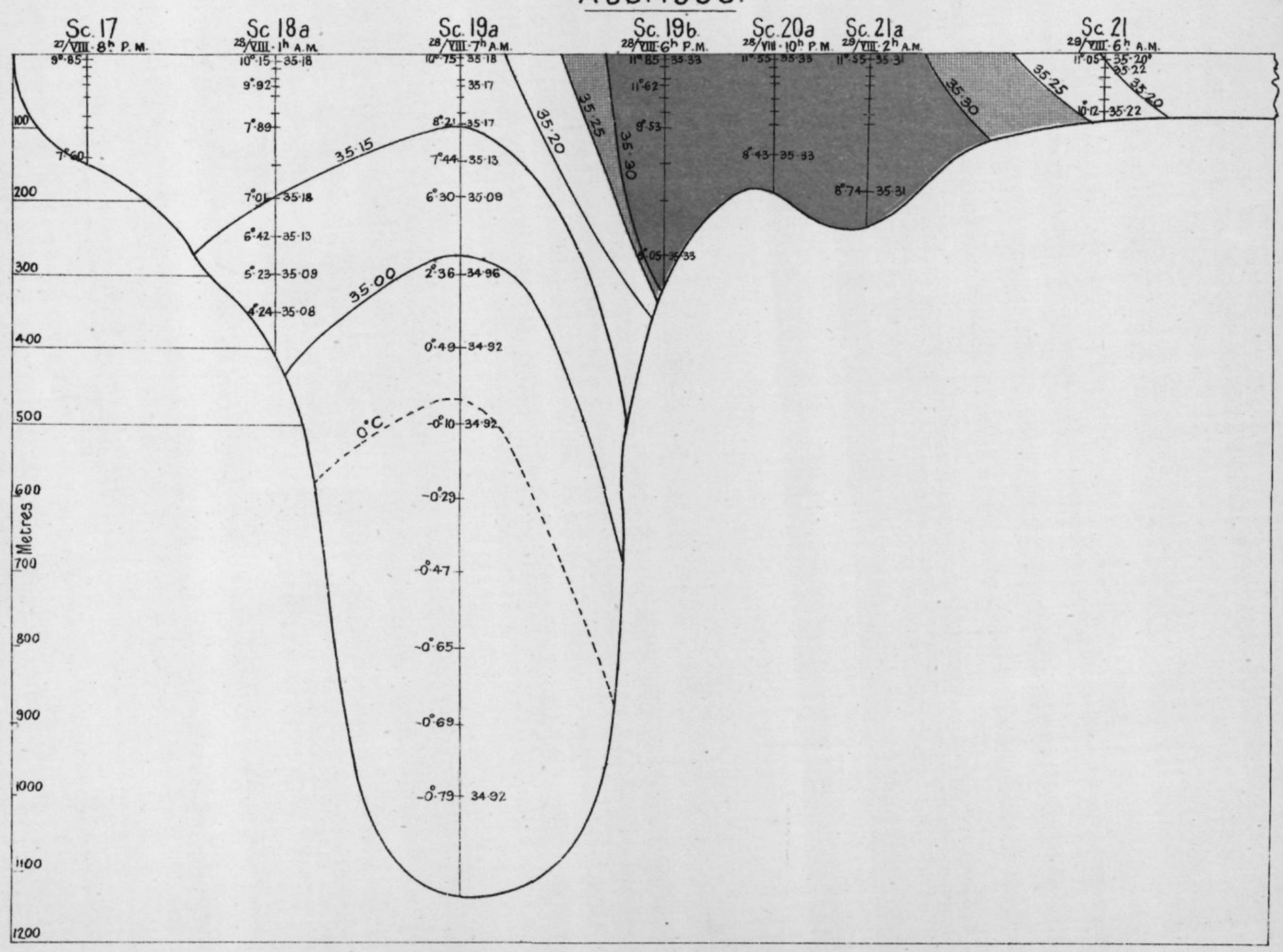
Northern Section.

Aug._Sept. 1906.



2. Southern Section.

Aug. 1906.



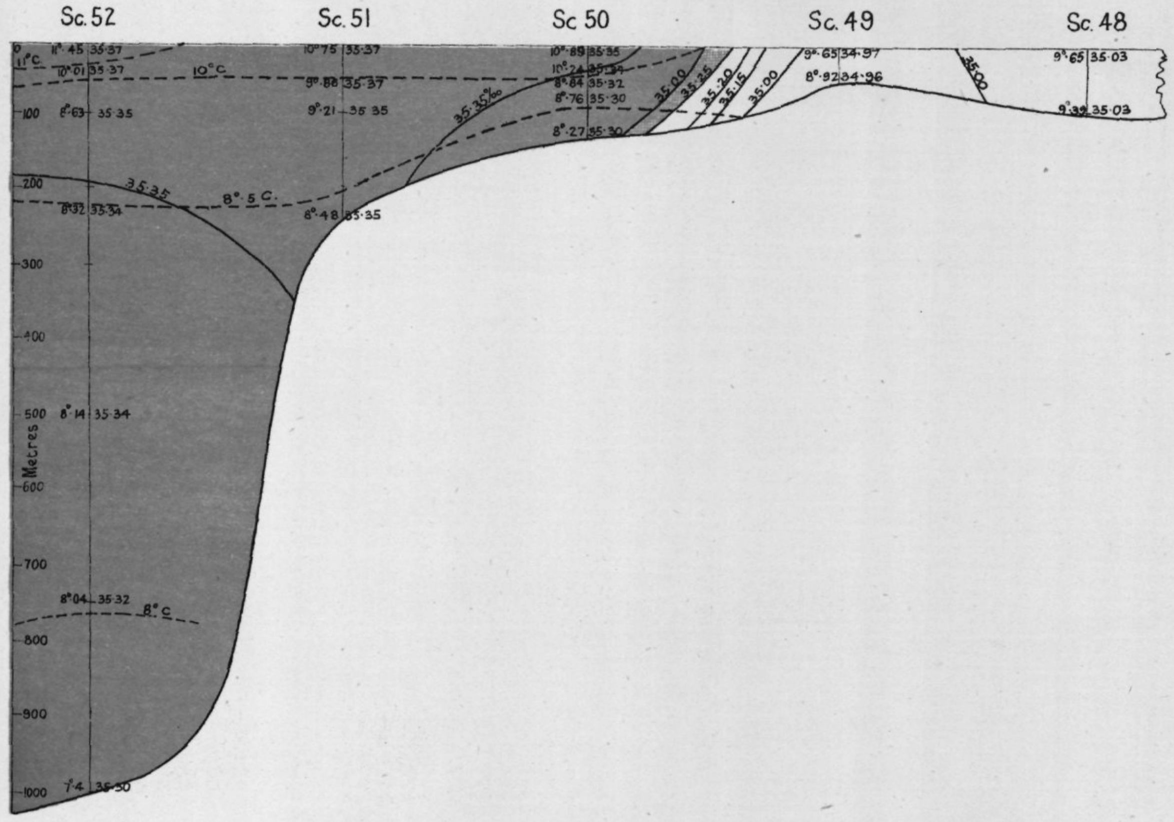
Horizontal Scale 1:2,000,000 Vertical Scale. 1:10,000

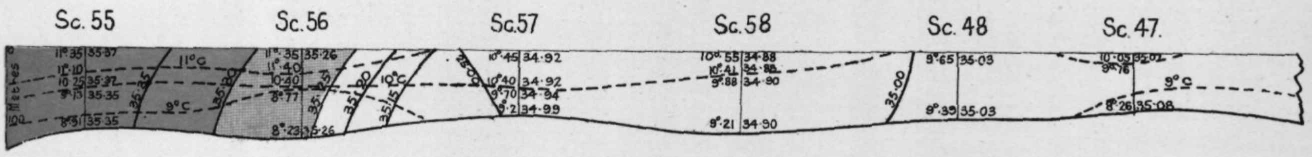
2204.

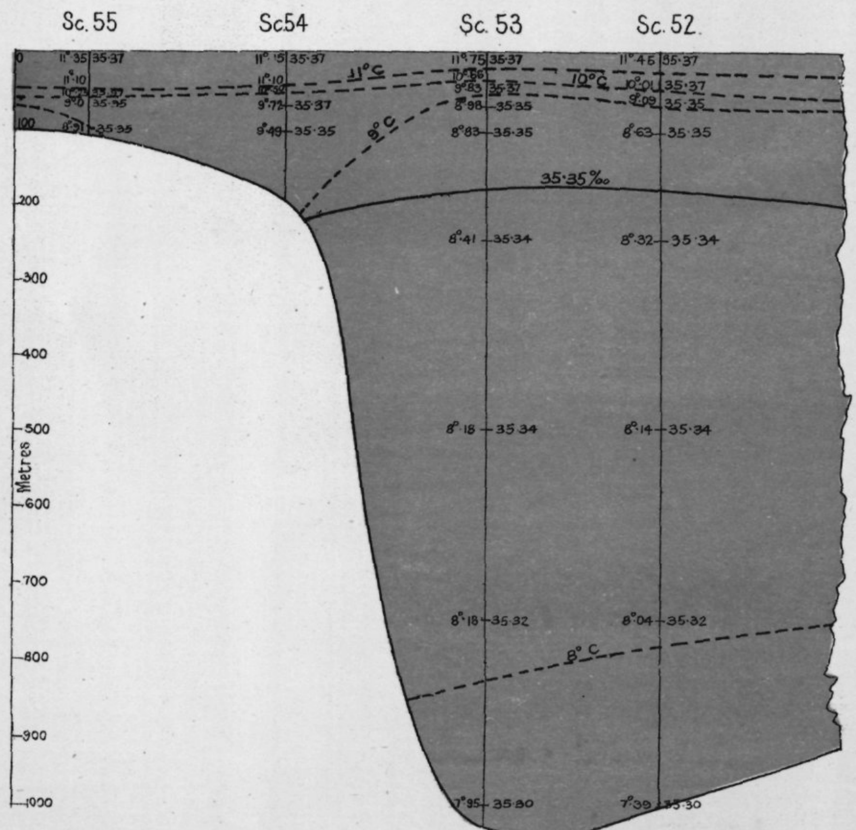
Weller & Graham, Ltd Litho. London.

I. North Atlantic Section.

July 1906.







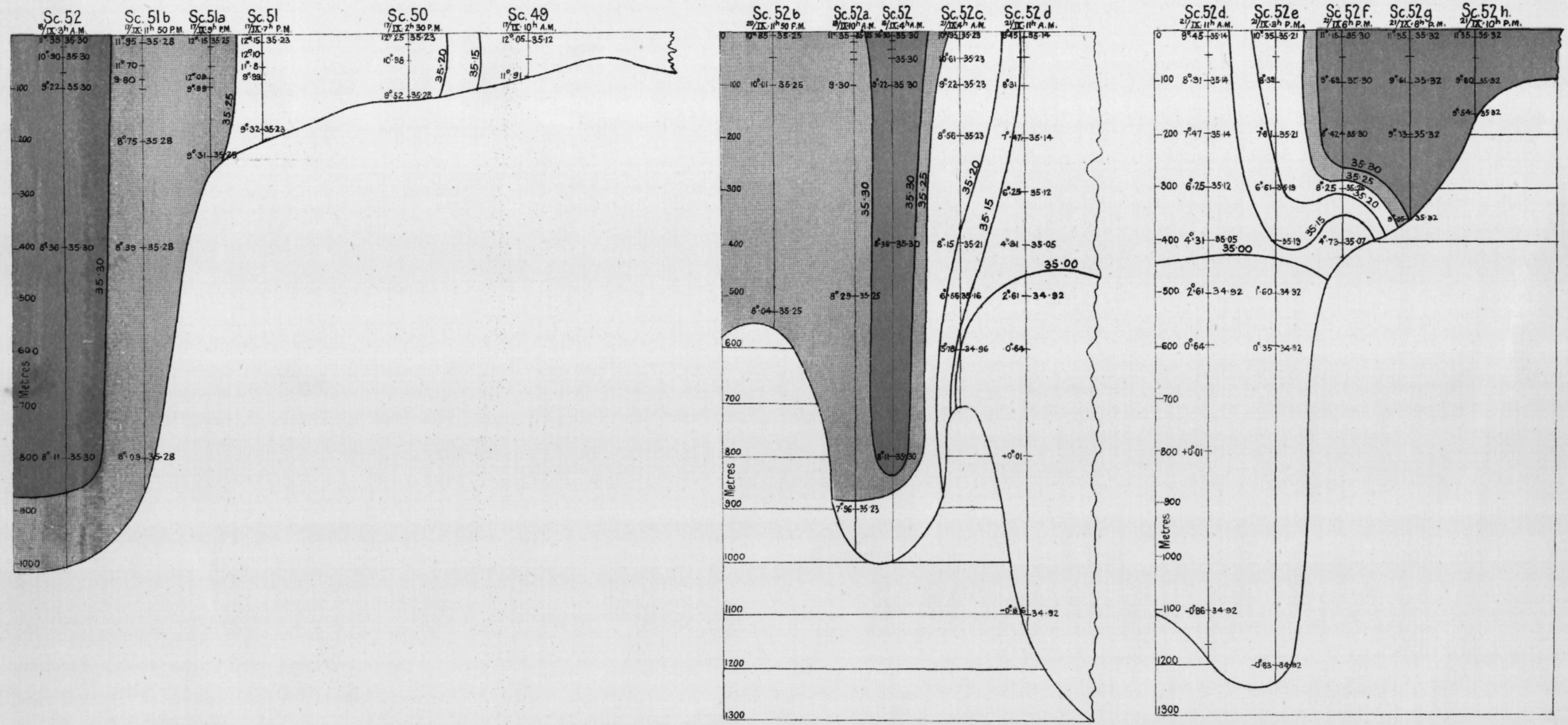
Horizontal Scale 1:2,000.000 Vertical Scale 1:10,000

2204.

Weller & Graham, Ltd. Litho. London.

I. North Atlantic Section.

Sept. 1906.



Horizontal Scale 1:200,000 Vertical Scale 1:10,000

Plate XIV.

OBSERVATIONS ON THE TEMPERATURE OF THE SURFACE WATERS OF THE NORTH SEA DURING THE YEARS 1906 AND 1907.

BY

FRANK G. YOUNG, B.Sc.

CONTENTS.

OBSERVATIONS ON THE TEMPERATURE OF THE SURFACE WATERS OF THE NORTH SEA DURING THE YEARS 1906 AND 1907.

BY

FRANK G. YOUNG, B.Sc.

As in previous years the investigation of the monthly changes in the temperature and salinity of the surface waters of the North Sea has again been conducted, the observations as before having been taken by the captains of passenger ships on various routes between North Sea ports.

East Coast Inshore Observations.

The temperature observations of the surface water along the eastern shores of Scotland and England have been made by Captain Dawson and Captain Thomson of the Edinburgh and London Shipping Company, Ltd. Observations have also been taken at Rattray Head Lighthouse (Mr. Mowat), at the Abertay Light-vessel (Mr. Swadel), and at the North Carr Light-vessel (Mr. Kirkpatrick and Mr. Wilson).

The following tables shew the mean midmonthly temperatures for the years 1906 and 1907 at various points along the east coast from Rattray Head Lighthouse to Orfordness—the temperatures in each case being in degrees centigrade.

Table I.—Surface Temperatures at Lightships on the East Coast of Scotland, 1906, 1907 (Mr. Kirkpatrick, Mr. Wilson, Mr. Swadel, Mr. Mowat).

—	North Carr.		Abertay.		Rattray Head.	
	1906.	1907.	1906.	1907.	1906.	1907.
Jan.	6·35	5·48	5·78	4·77	5·70	5·34
Feb.	5·01	4·33	4·48	3·77	4·66	4·59
Mar.	4·67	4·94	4·36	4·80	4·58	5·08
Apr.	5·80	6·18	5·87	6·43	5·96	6·11
May	7·32	7·67	7·58	7·88	7·38	7·97
June	10·62	9·21	9·97	9·38	10·21	9·72
July	11·39	11·92	11·99	12·00	11·97	11·44
Aug.	12·61	11·86	12·80	12·19	12·19	12·00
Sept.	12·63	11·70	12·72	11·86	12·22	11·61
Oct.	11·31	10·89	10·88	10·94	10·88	10·52
Nov.	9·29	9·44	10·27	8·69	9·18	9·00
Dec.	7·35	7·58	7·64	6·24	6·88	6·86
Mean	8·69	8·43	8·69	8·25	8·49	8·35

Mean of the three stations (1906), 8·62; (1907), 8·34.

TABLE II.—Mean Monthly Surface Temperatures, 1906, 1907, East Coast: Leith to London (Captains Thomson and Dawson).

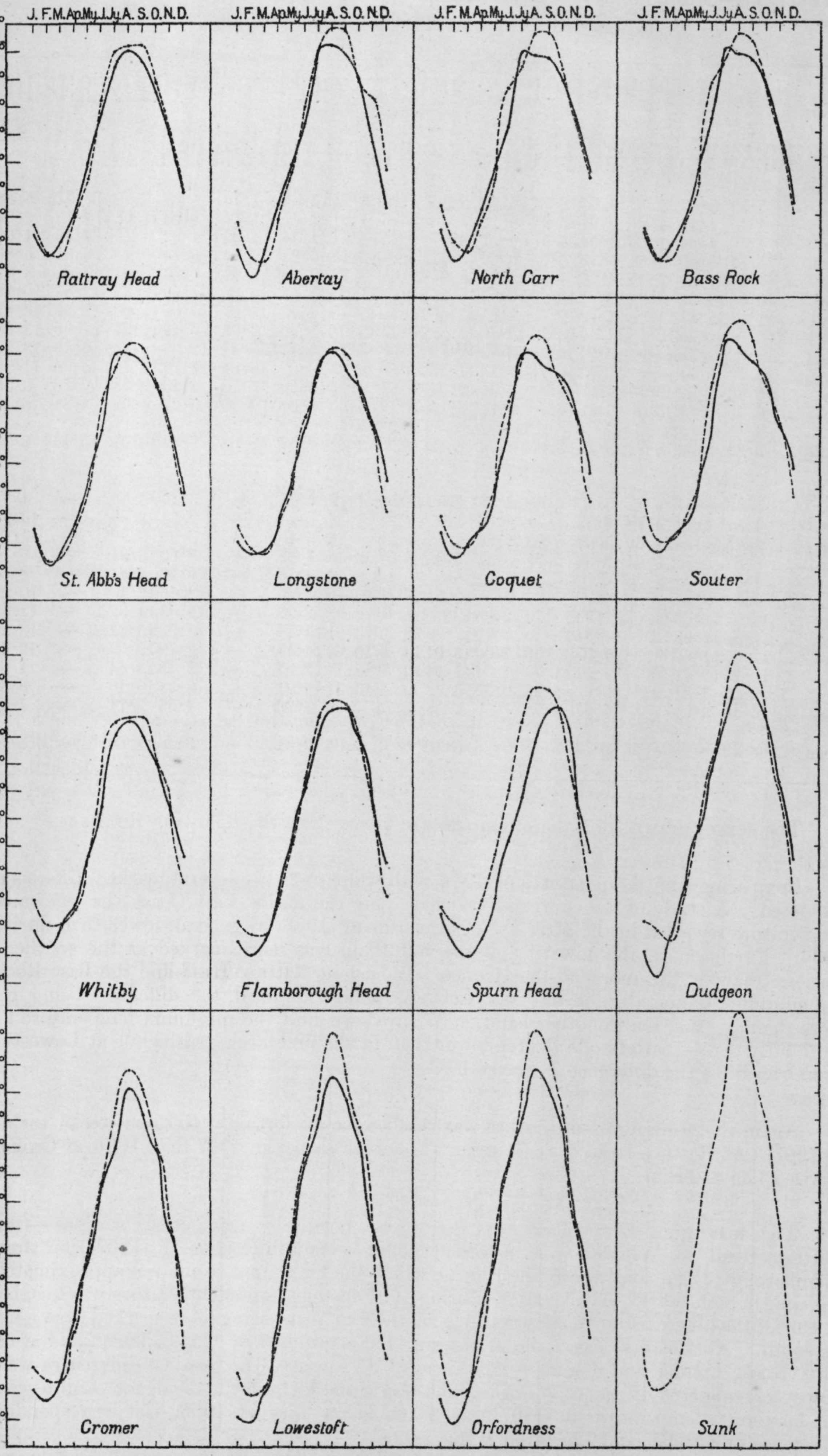
Year.	Bass Rock.	St. Abbs.	Longstone.	Coquet.	Souter.	Whitby.	Flamboro'.	Spurn.	Dudgeon.	Cromer.	[Newarp].	Lowestoft.	Orfordness.	[Sunk].	Mean.
1906.															
Jan. ...	5·52	5·60	5·70	6·04	6·64	6·03	5·26	5·76	5·24	4·96	[4·78]	4·73	5·50	[5·57]	5·58
Feb. .	4·42	4·44	4·87	5·02	5·17	5·12	4·78	5·16	4·91	4·47	[4·19]	3·93	4·03	[4·12]	4·84
Mar. ...	4·40	4·54	4·67	4·94	5·16	5·17	4·77	4·95	4·57	4·44	[4·35]	4·22	4·10	[4·46]	4·66
April ...	5·67	5·49	5·63	5·75	5·88	5·69	5·89	5·97	6·18	6·22	[6·14]	6·13	5·78	[6·01]	5·86
May ...	7·17	7·04	7·05	7·16	7·30	7·63	8·04	7·65	8·70	9·12	[9·41]	9·70	8·61	[10·01]	8·01
June ...	10·80	10·29	9·64	10·21	10·91	10·93	10·46	10·02	11·04	11·68	[12·28]	12·70	12·33	[12·81]	10·92
July ...	11·61	11·47	11·36	11·79	12·63	12·55	12·69	12·50	13·43	14·42	[14·69]	15·00	15·03	[15·42]	12·87
Aug. ...	12·61	12·35	12·15	12·59	13·14	12·70	13·31	13·75	15·01	15·80	[16·59]	17·14	17·27	[17·95]	13·99
Sept. ...	12·32	12·18	11·94	12·04	12·43	12·73	13·18	13·68	14·72	15·12	[15·44]	15·65	16·26	[16·19]	13·52
Oct. ...	10·73	10·91	10·65	10·72	10·76	11·14	11·98	12·50	12·93	13·07	[13·64]	13·74	14·16	[13·96	11·96
Nov. ...	8·86	9·09	9·19	9·58	9·42	9·40	9·34	9·67	9·97	10·20	[10·10]	9·93	9·98	[10·26]	9·55
Dec. ...	6·05	6·44	6·08	6·55	6·70	6·66	6·16	6·16	5·50	5·61	[6·20]	5·24	6·02	[4·88]	6·10
Mean ...	8·35	8·32	8·24	8·53	8·85	8·74	8·82	8·98	9·35	9·59	[9·82]	9·84	10·01	[10·14]	8·98
1907.															
Jan. ...	5·40	5·57	5·11	5·46	5·26	4·92	4·52	5·50	4·16	4·11	—	3·10	3·78	—	4·91
Feb. ...	4·38	4·28	4·68	4·53	4·72	4·30	4·01	3·98	3·26	3·74	—	2·94	2·88	—	3·98
Mar. ...	4·95	4·75	4·80	5·00	5·22	5·06	4·58	4·58	4·76	4·40	—	3·98	3·90	—	4·66
April ..	5·87	5·76	5·61	5·56	5·71	5·81	6·23	6·07	6·43	6·63	—	6·80	6·91	—	6·12
May ...	7·68	7·38	7·38	7·10	7·30	7·61	8·21	8·16	8·54	8·76	—	9·50	8·81	—	8·04
June ...	9·52	9·17	9·26	9·39	9·26	9·46	10·11	9·73	10·76	11·60	—	12·46	12·40	—	10·26
July ...	12·02	11·98	11·53	11·93	12·40	12·03	12·08	11·78	12·53	12·98	—	14·03	14·02	—	12·44
Aug. ...	11·86	11·98	12·00	11·86	12·18	12·59	12·96	12·91	13·91	15·11	—	15·53	15·84	—	13·22
Sept. ...	11 67	11·60	11·38	11·38	11·66	12·00	13·01	13·06	13·66	14·18	—	14·72	15·09	—	12·78
Oct. ...	10·71	10·77	10·72	11·01	11·00	11·04	11·94	12·74	12·74	12·98	—	13·19	13·64	—	11·87
Nov. ...	9·02	9·24	9·31	9·65	9·32	9·32	9·42	9·89	10·34	9·91	—	9·98	10·18	—	9·63
Dec. ...	6·46	6·90	7·31	7·57	7·78	7·59	7·36	7·74	7·50	7·32	—	7·56	7·74	—	7·40
Mean ...	8·29	8·28	8·26	8·37	8·48	8·48	8·70	8·85	9·05	9·31	—	9·48	9·60	—	8·77

The curves drawn from these temperature tables show the following results :—

Comparing the temperatures of 1906 with those of 1907, several marked differences are noted. A study of the curves shows that along the entire East Coast the minimum temperature recorded in the early spring was, during 1907, in general, lower than during 1906. Furthermore, this lowering of the minimum was more marked at the southerly stations than at the more northerly ones. Indeed, at Rattray Head and the Bass Rock, the minimum temperature in the two years was almost identical, the difference being not more than $\frac{1}{10}$° C. On the other hand, at Whitby, we find the minimum temperature for 1907 fully three-quarters of a degree lower than in the preceding year, while at Lowestoft and Orfordness the difference is nearly 1° C.

Again the minimum temperature was reached from a fortnight to three weeks earlier in 1907. At Rattray Head the minimum was a week earlier in 1907 than 1906, at Cromer it was 23 days earlier.

The maximum temperature at the more northerly east coast stations—from Rattray Head to Whitby—was recorded about a month earlier in 1907, but from Flamborough Head southwards the time at which the maximum occurs was approximately the same in both years. At all stations during 1907 the maximum temperature was less than in 1906—the difference in the observations for the two years being more marked from north to south. At Rattray Head the maximum temperature was ·25° C. lower, and at the Bass Rock, Coquet and Flamborough Head ·5° C. lower. The greatest differences were, however, registered off the coasts of Norfolk and Suffolk. At the Dudgeon Light-vessel the maximum temperature in 1907 was 2° C. below that of 1906, the corresponding difference off Cromer and Lowestoft being 1·5° C.



2204.

Surface Temperature at East Coast Lightships.
1906------ 1907——

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The mean temperature curve compiled month by month for all stations on the East Coast, between Rattray Head and Orfordness, for the four years—1904 to 1907, affords an interesting comparison.

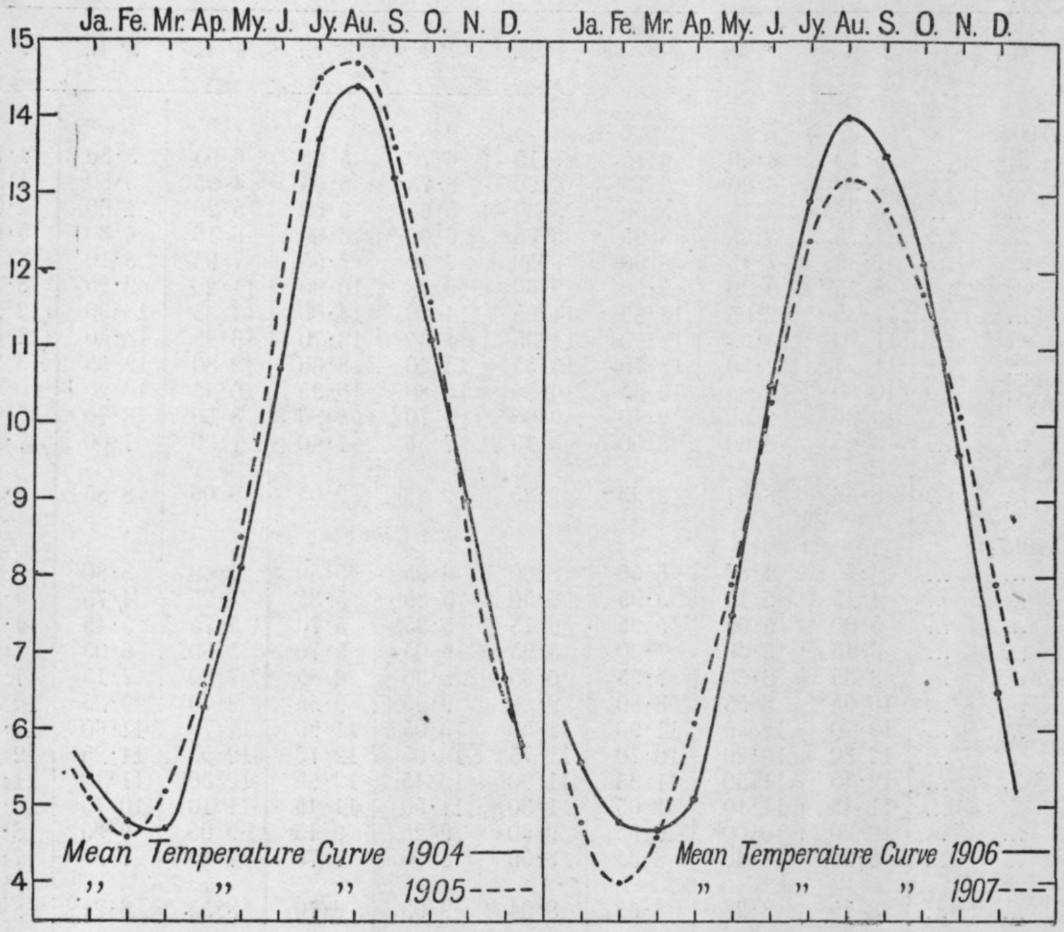

FIG. 2.

The following table shows the most characteristic differences in these curves during the four years :—

Year.	Approximate.			
	Minimum Temperature.	Date of Minimum.	Maximum Temperature.	Date of Maximum.
1904	4·6	Mar. 11th	14·4	Aug. 15th
1905	4·5	Feb. 22nd	14·8	Jul. 28th
1906	4·6	Mar. 4th	14·0	Aug. 17th
1907	4·0	Feb. 15th	13·3	Aug. 21st

In both 1906 and 1907 we have no indication on our curves of the abnormal winter inflow of warm (Atlantic) water which was so conspicuous in the early part of November 1905, and which was then so strongly marked in the records from Rattray Head lighthouse and the Abertay lightship.

CROSS ROUTE WORK.

During the years 1906–1907 temperature readings were made along the following routes :—

Leith to Christiansand—Captain Stark and Captain Parker ; Harwich to Hamburg —Captain Hunnisett and Captain Wright ; Leith to Hamburg—Captain Grierson and Captain Browne ; Newcastle to Bergen—Captain Oxholm and Captain Hovland ; Forth to Aalesund and (1906) to Stavanger—Captain Syrdahl and Captain Jörgensen ; Hamburg to Bergen (1907)—Captain Hensen ; Copenhagen to New York (1907)—Captain Wulff, Captain Hempel, and Captain Holst ; Ostende to Tilbury Dock (1907)—s.s. *Ville D'Anvers.*

The results are embodied in the following tables :—

Table III.—Mean Monthly Surface Temperatures, 1906, 1907, Leith to Christiansand (Captain Stark).

Year.	2° W.	1° W.	0°.	1° E.	2° E.	3° E.	4° E.	5° E.	6° E.
1906.									
Jan.	6·10	6·00	6·45	7·15	6·70	5·25	6·05	5·80	4·70
Feb.	5·30	6·20	6·15	6·20	6·75	5·95	4·95	5·60	4·50
Mar.	5·00	5·15	5·50	5·30	5·65	5·65	5·20	4·60	4·05
April	4·75	5·25	5·95	5·95	6·00	6·00	6·15	6·30	5·60
May	7·35	7·45	8·00	7·50	7·50	7·55	7·95	8·10	8·70
June	8·95	9·20	9·50	9·60	10·25	10·90	11·20	9·95	8·90
July	11·35	12·05	13·85	14·05	14·10	14·00	14·35	13·95	(12·20)
Aug.	11·70	13·55	13·50	14·35	14·35	13·70	13·85	13·50	(12·80)
Sept.	11·95	12·50	13·70	13·55	13·20	13·30	12·80	12·55	13·25
Oct.	10·60	10·85	10·55	10·20	10·80	10·95	10·45	10·20	10·40
Nov.	10·20	9·60	9·10	9·00	8·70	8·80	8·50	8·70	7·85
Dec.	8·25	8·60	8·50	8·15	7·55	7·40	7·30	7·00	7·20
Mean	8·46	8·87	9·23	9·25	9·29	9·05	9·06	8·85	8·35
1907.									
Jan.	3·75	4·80	6·55	8·00	6·95	5·50	4·60	3·80	3·60
Feb.	4·15	5·15	5·95	6·50	5·85	5·35	5·25	4·75	4·20
Mar.	5·00	5·65	5·95	6·15	5·95	5·70	5·75	5·45	4·25
April	6·45	5·00	7·30	5·95	6·05	5·70	5·80	6·05	4·75
May	8·35	6·50	7·55	6·95	6·95	6·85	7·00	7·15	7·10
June	10·55	8·55	8·80	9·20	9·25	9·35	9·70	9·25	10·30
July	12·20	12·55	11·00	11·50	13·05	11·90	11·70	11·60	11·95
Aug.	12·30	10·20	10·70	11·75	13·05	12·75	12·55	11·25	12·45
Sept.	12·15	11·50	11·35	11·90	12·45	12·65	12·30	11·40	11·95
Oct.	11·45	11·10	11·05	11·30	11·50	11·45	11·10	10·75	10·55
Nov.	10·20	10·00	9·35	9·50	9·25	9·45	9·05	9·25	8·55
Dec.	8·50	8·40	8·35	8·55	8·00	7·75	7·85	7·85	7·00
Mean	8·75	8·28	8·66	8·94	9·03	8·70	8·55	8·21	8·05

Table IV.—Mean Monthly Surface Temperatures, 1906, 1907, Harwich to Hamburg (Captains Hunnisett and Wright).

Year.	2° E.	3° E.	4° E.	5° E.	6° E.	7° E.	8° E.
1906.							
Jan.	6·90	6·04	6·58	6·12	4·60	4·14	4·99
Feb.	5·04	4·88	4·33	4·51	4·34	4·01	3·45
Mar.	—	4·76	4·79	4·56	4·53	3·99	2·70
April	6·85	5·43	6·18	6·41	5·86	5·41	5·09
May	8·73	8·41	9·02	9·88	9·96	9·42	8·46
June	10·78	10·92	11·70	12·20	12·21	12·47	13·24
July	—	13·52	14·51	15·83	15·70	15·25	15·46
Aug.	—	15·69	16·11	16·93	16·64	15·53	15·82
Sept.	16·08	15·41	15·54	16·34	16·22	16·03	15·67
Oct.	15·07	13·94	13·98	14·00	13·73	13·37	13·08
Nov.	10·87	11·61	11·38	11·16	10·79	10·47	10·70
Dec.	6·70	7·66	7·05	6·88	6·39	6·21	5·73
Mean	—	9·86	10·10	10·40	10·08	9·69	9·53
1907.							
Jan.	5·31	5·58	5·18	4·93	4·31	4·24	3·71
Feb.	3·27	3·45	3·34	2·82	2·32	1·50	0·50
Mar.	—	—	—	—	—	—	—
April	—	—	—	—	—	—	—
May	8·34	8·36	9·44	10·09	10·38	9·67	9·00
June	11·62	11·10	11·80	12·73	12·90	12·65	12·65
July	13·72	13·09	14·04	14·66	14·50	14·17	14·43
Aug.	15·32	14·80	15·27	15·76	15·85	15·51	15·06
Sept.	15·95	14·71	14·99	15·26	15·12	15·79	13·75
Oct.	14·24	14·09	14·12	14·18	13·75	13·56	13·25
Nov.	10·88	11·05	10·55	9·85	8·97	8·59	9·19
Dec.	8·15	8·18	7·83	7·20	6·37	5·96	6·25

TABLE V.—Mean Monthly Surface Temperatures, 1906, 1907, Leith to Hamburg (Captains Browne and Grierson).

Year.	2° W.	1° W.	0°.	1° E.	2° E.	3° E.	4° E.	5° E.	6° E.	7° E.	8° E.
1906.											
Jan. ...	6·69	6·91	6·61	6·42	6·04	5·60	5·83	5·80	5·37	4·92	4·30
Feb. ...	5·22	5·51	5·78	5·62	5·38	4·90	4·63	4·82	4·64	4·32	3·32
Mar. ...	4·76	4·94	5·21	5·36	5·20	4·95	4·48	4·28	4·10	4·89	3·12
April ...	5·36	5·54	5·76	5·62	5·91	5·87	5·69	5·45	5·61	5·89	5·97
May ...	6·92	6·80	7·11	7·50	7·81	8·07	8·11	8·60	8·70	8·43	8·52
June ...	10·68	10·33	10·65	10·87	11·23	11·56	11·46	11·63	12·01	12·51	13·18
July ...	12·01	12·83	13·68	13·82	14·04	14·38	14·56	14·70	15·18	15·56	15·25
Aug. ...	12·86	13·57	14·90	15·29	15·34	15·68	15·86	16·07	16·06	16·27	16·89
Sept. ...	13·01	13·31	14·10	14·52	14·63	15·25	15·50	15·45	16·09	16·21	16·10
Oct. ...	11·22	11·35	11·73	12·22	13·14	13·79	13·83	14·39	14·77	14·33	13·80
Nov. ...	9·48	9·65	9·26	8·87	9·80	10·72	11·20	11·88	12·04	11·49	11·14
Dec. ...	7·83	7·98	7·91	7·66	7·36	7·30	8·40	9·11	8·82	7·96	6·62
Mean ...	8·84	9·06	9·39	9·48	9·66	9·84	9·96	10·18	10·28	10·23	9·85
1907.											
Jan. ...	6·32	6·49	6·51	6·37	6·21	6·20	5·65	5·92	5·65	4·94	4·12
Feb. ...	4·71	5·34	5·65	5·72	5·45	4·59	4·36	4·40	3·78	2·78	1·94
Mar. ...	4·54	4·96	5·25	5·49	5·60	5·40	4·70	4·29	3·86	3·36	2·98
April ...	5·85	5·82	5·95	6·08	6·41	6·24	5·31	5·08	5·25	5·16	5·28
May ...	7·43	7·14	7·29	7·42	7·84	8·27	8·24	8·38	8·73	9·05	9·16
June ...	9·56	9·29	9·56	9·92	10·13	10·23	10·57	10·86	11·36	11·69	11·76
July ...	11·40	12·04	12·13	12·24	12·59	12·82	12·77	12·86	13·23	13·68	13·91
Aug. ...	11·79	12·49	12·82	12·77	12·92	13·45	13·39	13·71	14·26	14·69	15·04
Sept. ...	11·36	11·93	12·53	12·84	13·08	13·58	13·92	14·13	14·65	14·77	14·49
Oct. ...	11·01	11·53	11·91	11·96	12·57	13·18	13·54	14·00	14·14	13·87	13·81
Nov. ...	9·78	9·54	9·44	9·66	10·25	10·93	11·55	12·09	11·34	10·51	11·11
Dec. ...	7·57	8·10	8·05	7·64	7·52	7·67	8·05	8·60	8·38	7·61	6·85
Mean ...	8·44	8·72	8·92	9·01	9·21	9·38	9·34	9·53	9·55	9·34	9·20

TABLE VI.—Mean Monthly Surface Temperatures at Danish Lightships, 1906, 1907.

Year.	Skaw.		Vyl.		Horn Reef.	
	1906.	1907.	1906.	1907.	1906.	1907.
Jan.	3·3	3·2	3·0	3·5	3·8	4·5
Feb.	2·6	1·4	2·5	1·0	3·2	2·0
Mar.	2·5	2·8	2·7	2·4	3·0	1·7
April	4·6	4·9	4·9	4·8	4·5	4·7
May	9·6	8·3	9·3	8·2	8·8	7·8
June	15·0	11·6	11·5	11·5	11·6	10·9
July	15·1	14·5	14·0	13·7	13·9	13·7
Aug.	16·1	14·1	16·5	14·6	15·9	14·1
Sept.	14·3	12·7	15·5	13·9	15·3	13·7
Oct.	11·6	12·2	13·0	13·4	13·4	13·5
Nov.	8·5	9·0	9·9	9·4	10·6	10·0
Dec.	6·0	5·4	6·1	6·5	7·2	7·4
Mean	9·1	8·3	9·1	8·7	9·3	8·7

TABLE VII.—Mean Monthly Surface Temperatures, 1906, 1907, Newcastle to Bergen (Captains Hovland and Oxholm).

Year.	1° W.	0°30′W.	0°	0° 30′ E.	1° E.	1° 30′ E.	2° E.	2° 30′ E.	3° E.	3° 30′ E.	4° E.	4° 30′ E.
1906.												
Jan. ...	6·80	7·16	7·31	7·38	7·45	7·20	6·92	6·76	6·35	6·39	5·85	6·00
Feb. ...	5·40	5·53	5·68	5·68	5·85	6·01	5·94	5·83	5·78	5·49	5·08	4·80
Mar. ...	4·96	5·28	5·46	5·19	5·22	5·33	5·34	5·38	5·02	4·94	4·61	4·07
April ...	5·56	5·65	5·67	5·74	6·06	6·14	6·18	6·06	6·62	6·58	5·68	4·85
May ...	6·30	6·48	6·50	6·78	6·88	6·96	7·13	7·11	7·13	7·21	7·06	7·25
June ...	9·18	9·41	9·60	9·50	9·54	9·59	9·84	10·03	10·09	10·21	10·38	10·53
July ...	12·16	12·06	12·06	11·94	11·78	12·11	12·69	13·05	13·06	12·80	12·32	11·98
Aug. ...	13·00	13·30	13·40	13·40	13·40	13·30	13·40	13·40	13·30	13·40	13·60	13·80
Sept. ...	12·98	13·40	13·58	13·72	13·80	13·80	13·57	13·42	13·33	13·30	13·10	13·20
Oct. ...	11·20	11·35	11·40	11·50	11·80	12·03	11·98	11·70	11·45	11·10	11·60	11·70
Nov. ...	9·24	8·90	9·16	8·96	8·97	8·78	8·65	8·80	8·67	8·72	8·65	8·37
Dec. ...	7·32	7·31	7·19	7·12	7·09	7·11	7·21	7·11	7·11	7·16	7·04	6·80
Mean ...	8·68	8·82	8·92	8·91	8·99	9·03	9·07	9·05	8·99	8·94	8·75	8·61
1907.												
Jan. ...	6·39	6·36	6·43	6·44	6·44	6·53	6·35	6·22	6·20	6·28	6·41	6·46
Feb. ...	5·93	6·02	6·10	6·13	5·97	5·81	5·77	5·72	5·66	5·60	5·09	5·47
Mar. ...	6·20	6·00	5·93	6·05	6·18	6·10	6·05	6·03	6·20	6·45	6·43	6·18
April ...	5·45	5·86	6·05	6·07	6·08	6·02	6·01	5·99	5·96	5·94	5·96	5·92
May ...	6·88	6·55	6·45	6·49	6·51	6·48	6·45	6·55	6·84	7·13	7·06	6·68
June ...	9·51	9·39	9·37	9·37	9·27	9·23	9·31	9·50	9·50	9·48	9·68	10·05
July ...	12·12	11·86	11·69	11·62	11·61	11·68	11·81	11·99	12·03	11·96	12·09	12·41
Aug. ...	12·78	12·49	12·27	12·16	12·21	12·27	12·47	12·62	12·63	12·59	12·55	12·79
Sept. ...	11·60	11·95	12·01	12·10	12·05	12·10	12·19	11·96	11·71	11·60	11·68	11·72
Oct. ...	11·15	11·26	11·36	11·36	11·36	11·46	11·51	11·40	11·26	11·18	11·10	10·87
Nov. ...	9·89	9·71	9·68	9·52	9·37	9·41	9·53	9·53	9·50	9·57	9·60	9·25
Dec. ...	7·97	7·97	7·93	7·86	7·79	7·78	7·68	7·63	7·63	7·78	7·76	7·78
Mean ...	8·82	8·79	8·76	8·76	8·74	8·74	8·76	8·76	8·76	8·80	8·78	8·80

TABLE VIII.—Mean Monthly Surface Temperatures, Firth of Forth to Aalesund (Captains Syrdahl and Jörgensen).

Year.	2° W.	1° W.	0°.	1° E.	2° E.	3° E.	4° E.	5° E.
1906.								
Jan.	6·55	7·33	7·56	7·19	7·38	8·10	6·94	5·98
Feb.	5·40	6·77	6·82	7·07	7·25	6·70	5·28	4·65
Mar.	5·40	6·05	6·25	6·05	5·35	5·10	5·00	4·80
April	5·90	6·20	6·05	6·40	6·55	6·65	5·25	5·40
May	7·70	7·50	7·50	7·20	7·05	7·05	6·55	6·70
June	—	11·60	10·40	11·15	11·30	11·55	10·45	—
July	—	10·75	11·40	9·95	10·30	10·55	11·65	12·60
Aug.	—	12·45	13·75	13·75	14·05	14·50	14·50	14·05
Sept.	12·30	11·60	11·75	12·05	12·30	11·55	13·05	13·35
Oct.	11·43	11·25	11·13	10·93	10·60	10·43	10·60	—
Nov.	10·35	9·60	7·95	8·40	8·50	9·40	9·55	9·40
Dec.	—	7·78	7·53	7·23	6·98	7·15	6·98	6·05
Mean	—	9·08	9·01	8·96	8·97	9·06	8·82	—
1907.								
Jan.	6·85	7·30	7·25	7·40	7·50	7·25	6·55	—
Feb.	5·40	6·50	6·50	6·00	6·10	6·80	6·05	—
Mar.	5·40	6·05	6·10	5·70	6·15	6·50	5·95	—
April	6·10	6·10	6·30	6·05	6·80	6·70	6·10	—
May	7·30	7·50	7·25	7·35	7·90	7·60	6·60	—
June	8·95	9·60	9·00	9·10	8·85	9·10	9·75	—
July	10·65	10·50	10·75	10·75	11·15	11·00	11·30	—
Aug.	11·75	11·50	11·20	11·25	11·50	10·75	11·55	—
Sept.	11·95	11·50	10·85	11·05	10·80	9·95	11·45	—
Oct.	11·25	10·65	10·10	10·25	9·90	9·55	10·95	—
Nov.	9·95	9·60	9·60	9·05	9·00	9·00	9·40	—
Dec.	8·25	8·50	8·40	7·90	8·00	8·20	7·70	—
Mean	8·65	8·77	8·61	8·49	8·64	8·53	8·61	—

TABLE IX.—Mean Monthly Surface Temperatures, Firth of Forth to Stavanger (Captains Syrdahl and Jörgensen).

Year.	2° W.	1° W.	0°.	1° E.	2° E.	3° E.	4° E.	5° E.
1906.								
Jan.	6·65	7·00	7·20	7·45	7·50	6·30	4·55	4·50
Feb.	5·53	5·53	5·87	6·33	6·20	6·38	5·90	4·95
Mar.	4·70	5·05	5·25	5·40	5·50	5·55	4·85	4·10
April	4·50	6·00	6·20	6·25	5·85	5·90	4·70	4·45
May	5·90	6·20	6·40	6·45	6·50	6·50	6·05	5·35
June	7·75	7·70	7·60	7·90	7·60	9·00	9·15	7·00
July ... ... / Aug.	} 12·30	12·75	13·55	13·70	14·10	14·70	15·20	16·55
Sept.	—	11·70	13·20	13·10	13·35	12·85	13·60	13·25
Oct.	11·30	10·95	10·65	10·50	10·50	10·25	10·00	9·85
Nov.	8·85	8·95	9·25	9·30	9·05	9·00	8·65	8·45
Dec.	7·10	7·80	8·00	8·00	7·70	7·50	7·40	6·80
Mean	—	8·53	8·89	9·01	9·00	9·05	8·75	8·47

TABLE X.—Mean Monthly Surface Temperatures, Bergen to Hamburg (Captain Hansen).

Year. Lat. Long.	58° 00′ N. 6° 30′ E.	57° 30′ N. 6° 43′ E.	57° 00′ N. 6° 55′ E.	56° 30′ N. 7° 6′ E.	56° 00′ N. 7° 16′ E.	55° 30′ N. 7° 26′ E.	55° 00′ N. 7° 36′ E.
1907.							
Jan.	4·2	4·65	6·25	4·80	4·95	4·45	3·20
Feb.	3·15	4·25	4·75	4·05	3·90	3·25	2·75
Mar.	3·35	4·30	3·90	4·10	3·50	3·40	3·15
April	4·45	4·85	4·50	4·95	4·75	4·85	5·20
May	6·45	6·40	6·35	6·65	6·70	7·75	8·50
June	8·60	9·15	9·10	9·45	9·45	11·85	11·95
July	10·80	12·20	12·05	12·75	12·40	14·50	14·25
Aug.	12·35	12·95	13·10	13·80	13·95	14·45	13·85
Sept.	12·35	11·85	12·15	13·35	13·65	13·80	13·91
Oct.	11·00	11·35	12·25	13·20	13·60	13·70	14·30
Nov.	8·70	9·50	11·20	11·45	11·15	10·90	10·45
Dec.	6·50	7·30	7·40	8·05	7·25	6·55	6·00
Mean	7·66	8·23	8·58	8·88	8·77	9·12	8·96

TABLE XI.—Mean Monthly Surface Temperatures, Ostende to Tilbury Dock (S.S. "Ville D'Anvers").

Year. Lat. Long.	51° 30′ N. 1° 00′ E.	50° 30′ N. 1° 30′ E.	51° 24′ N. 2° 00′ E.	51° 20′ N. 2° 30′ E.	51° 16′ N. 2° 50′ E.
1907.					
Jan.	5·35	5·03	6·20	4·63	3·63
Feb.	—	—	—	—	—
Mar.	5·35	4·85	4·76	4·71	5·50
April	8·65	6·77	6·98	7·52	7·88
May	9·18	9·26	9·13	9·73	10·96
June	—	—	—	—	—
July	16·45	14·70	14·10	14·85	15·90
Aug.	16·90	15·47	15·97	16·95	16·92
Sept.	15·55	15·63	15·73	15·82	16·37
Oct.	12·75	14·08	14·65	14·62	13·78
Nov.	—	—	—	—	—
Dec.	7·53	8·98	10·45	9·97	8·30
Mean	—	—	—	—	—

TABLE XII.—Mean Monthly Surface Temperatures on the Eastern Part of the Route from Copenhagen to Pentland Firth (on Route to New York), (Captains Wulff, Holst and Hempel).

Year.	Lat. Long.	57° 52′ N. 8° 00′ E.	57° 58′ N. 7° 00′ E.	58° 8′ N. 6° 00′ E.	58° 8′ N. 5° 00′ E.	58° 12′ N. 4° 00′ E.	58° 17′ N. 3° 00′ E.	58° 21′ N. 2° 00′ E.	58° 25′ N. 1° 00′ E.	58° 28′ N. 0° 00′	58° 32′ N. 1° 00′ W.	58° 36′ N. 2° 00′ W.
1907.												
Jan.	...	6·30	5·45	5·00	5·50	6·05	6·65	7·15	7·75	8·00	8·00	8·00
Feb.	...	1·70	3·13	3·95	4·55	5·15	5·75	6·25	6·30	6·35	6·70	6·70
Mar.	...	3·40	3·05	2·35	1·98	2·90	3·68	4·33	4·87	5·33	5·64	6·04
April	...	6·25	5·02	5·48	5·83	6·18	6·33	6·02	5·34	6·05	6·92	7·23
May	...	8·35	8·30	8·30	7·45	6·33	6·60	6·65	6·70	7·13	7·48	7·63
June	...	11·25	10·93	10·43	9·84	9·29	9·28	9·35	9·16	8·89	9·54	9·59
July	...	13·93	13·53	13·19	12·90	12·50	12·33	12·11	11·81	11·58	11·33	10·99
Aug.	...	13·38	13·20	12·81	12·46	12·20	12·01	11·90	11·44	10·85	10·38	10·21
Sept.	...	11·45	9·05	9·90	10·15	10·35	10·30	10·27	10·30	10·75	10·80	10·50
Oct.	...	12·00	12·15	11·95	11·40	10·90	10·75	11·00	10·75	10·45	10·45	11·00
Nov.	...	11·05	10·70	8·53	9·10	9·48	9·55	9·50	9·50	9·50	9·78	10·00
Dec.	...	10·50	9·60	7·10	7·10	7·10	7·10	7·10	7·10	7·10	7·10	7·10
Mean	...	9·13	8·68	8·25	8·19	8·20	8·36	8·47	8·42	8·50	8·68	8·75

An examination of these tables bears out the remarks made when considering the surface temperatures of the stations on the East Coast of Scotland and England.

Especially at the inshore stations on our cross routes is it noticeable that the temperatures during the early months of 1907 were much lower than during the corresponding period of 1906. For instance a study of the Harwich-Hamburg route shows us that during February 1906 the mean temperature on this route was 4·35, while a year later it was about a couple of degrees lower, namely 2·45.

Further north this difference in the mean monthly temperatures for the two years under consideration was not so well marked, although still noticeable to an appreciable extent. Thus, on the Leith–Christiansand route during February 1906 the mean temperature was 5·7, during February 1907 it was 5·2—a difference of only half a degree. Again at the Leith–Aalesund stations the mean temperature during February 1906 was 6·0° C., and only 5·4° C. during February 1907. In the autumn months also the temperature of the surface waters was less in 1907 than in the previous year. On the Harwich-Hamburg route—the most southerly line of stations for which we have readings for both years—the following table gives the mean surface readings for the four months when the temperature was in the region of its maximum :—

	1906.		1907.
July	15·1	...	14·1
August	16·1	...	15·4
September	15·9	...	15·1
October	13·9	...	13·9

On the Leith–Christiansand route the mean surface temperature for the same four months of the two years was as follows :—

	1906.		1907.
July	12·0	...	12·0
August	13·7	...	11·9
September	13·0	...	11·9
October	10·6	...	11·4

A comparison of the temperatures for the two years shows accordingly that during the earlier months of 1906 the temperatures were higher than during the corresponding months of 1907, as were also the temperatures during the summer and autumn months. We also observe that these temperature differences were more marked in the more southerly shallower portions of the North Sea basin.

HARMONIC FORMULÆ.

The harmonic formulæ derived from the mean monthly temperatures at the different stations at which observations were taken have been calculated by Fourier's equation in the simplified form

$$f(\beta) = A_0 + a, \sin(\theta + e_1) + a_2 \sin(2\theta + e_2) +$$

These harmonic formulæ give us the mean annual temperature, the half range and the phase of each curve—factors which give us in their turn the mean maximum temperature, the mean minimum temperature, and the approximate date of these. These latter factors have been calculated for each North Sea station at which temperature records were made during 1906 and 1907, the results being included in the following tables :—

TABLE XIII.—Harmonic Constants for Mean Monthly Surface Temperatures at Scottish East Coast Lightships, 1906, 1907.

Station.	Longitude.	Latitude.	Year.	A.	A.	Mean Maximum.	Mean Minimum.	e.	Approximate date of Minimum.	A.	e.
	° ′	° ′						° ′			°
North Carr Lightship ...	2 33 W.	56 18 N.	1906	8·69	3·98	12·67	4·71	47 3	Feb. 27	·25	79
			1907	8·43	3·77	12·20	4·66	48 14	„ 26	·16	3
Abertay Lightship ...	2 41 W.	56 27 N.	1906	8·09	4·22	12·91	4·47	46 3	„ 28	·23	–47
			1907	8·25	4·29	12·54	3·96	49 27	„ 25	·247	75
Rattray Head Lightship	1 49 W.	57 37 N.	1906	8·49	4·00	12·49	4·49	50 47	„ 23	·02	74
			1907	8·35	3·63	11·98	4·72	44 3	Mar. 2	·075	58

TABLE XIV.—Harmonic Constants for Mean Monthly Surface Temperatures, Leith to London.

Station.	A_0.	A_1.	Mean Maximum.	Mean Minimum.	e_1.	Approximate date of Minimum.	A_2.	e_2.
					° ′			° ′
				1906.				
Bass Rock	8·35	4·24	12·59	4·11	53 3	Feb. 21	·25	48 11
St. Abbs	8·32	4·13	12·45	4·19	50 33	„ 24	·19	6 53
Longstone	8·24	3·89	12·13	4·35	49 43	„ 24	·32	31 13
Coquet Island ...	8·53	3·90	12·43	4·63	49 35	„ 24	·33	59 58
Souter Point ...	8·85	4·04	12·89	4·81	52 8	„ 22	·62	67 50
Whitby	8·74	4·15	12·89	4·59	52 21	„ 22	·38	65 56
Flamboro' Head ...	8·82	4·63	13·45	4·19	53 19	„ 21	·36	– 9 7
Spurn Point ...	8·98	4·64	13·62	4·34	48 56	„ 25	·58	–11 24
Dudgeon Light ...	9·36	5·39	14·73	3·97	54 13	„ 20	·61	–18 56
Cromer	9·59	5·93	15·52	3·66	56 7	„ 18	·53	–18 38
Newarp Light ...	9·82	6·25	16·07	3·57	56 8	„ 18	·40	– 5 53
Lowestoft	9·84	6·39	16·23	3·45	58 29	„ 16	·51	3 50
Orfordness	10·01	6·62	16·63	3·39	52 19	„ 21	·56	7 4
Sunk Light ...	10·14	6·73	16·87	3·41	58 30	„ 16	·68	5 14
				1907.				
Bass Rock	8·29	3·86	12·15	4·43	52 41	„ 21	·055	59 13
St. Abbs Head ...	8·28	3·88	12·16	4·40	48 52	„ 25	·12	84 18
Longstone	8·26	3·77	12·03	4·49	47 48	„ 26	·085	47 52
Coquet Island ...	8·37	3·80	12·17	4·57	45 38	„ 28	·21	48 49
Souter Point ...	8·48	3·86	12·34	4·62	47 38	„ 26	·196	84 44
Whitby	8·48	4·08	12·56	4·40	49 17	„ 25	·014	68 58
Flamboro' Head ...	8·70	4·56	13·26	4·14	51 9	„ 23	·34	76 35
Spurn Head ...	8·85	4·48	13·33	4·37	45 11	Mar. 1	·39	68 45
Dudgeon Light ...	9·05	5·12	14·17	3·93	51 11	Feb. 23	·61	68 27
Cromer	9·31	5·51	14·82	3·80	54 5	„ 20	·38	86 31
Lowestoft	9·48	6·17	15·65	3·31	57 22	„ 17	·56	53 20
Orfordness	9·60	6·24	15·84	3·36	54 24	„ 20	·44	62 5

TABLE XV.—Harmonic Constants for Mean Monthly Surface Temperatures, Leith to Christiansand.

Longitude.	Latitude.	A_0.	A_1.	Mean Maximum.	Mean Minimum.	e_1.	Approximate date of Minimum.	A_2.	e_2.
°	° ′					° ′			°
				1906.					
2 W.	56 18 N.	8·46	3·63	12·09	4·83	38 4	Mar. 8	·35	−70
1 W.	56 28 N.	8·87	3·85	12·72	5·02	42 48	„ 3	·69	55
0 W.	56 40 N.	9·23	4·02	13·25	5·21	49 14	Feb. 25	·97	55
1 E.	56 50 N.	9·25	4·09	13·34	5·16	48 57	„ 25	1·36	52
2 E.	57 01 N.	9·29	4·09	13·38	5·20	52 30	„ 21	1·27	52
3 E.	57 11 N.	9·05	4·38	13·43	4·67	55 55	„ 18	·86	48
4 E.	57 21 N.	9·06	4·47	13·53	4·59	58 17	„ 16	·86	70
5 E.	57 32 N.	9·85	4·33	13·18	4·52	57 16	„ 17	·87	58
6 E.	57 43 N.	8·35	4·70	13·05	3·65	55 57	„ 18	·60	45
				1907.					
2 W.	—	8·75	4·25	13·00	4·50	51 35	„ 22	·67	30
1 W.	—	8·28	3·57	11·85	4·71	39 40	„ 6	·22	−34
0 W.	—	8·66	2·70	11·36	5·96	41 33	„ 2	·17	85
1 E.	—	8·94	3·00	11·94	5·94	34 32	„ 11	·59	59
2 E.	—	9·03	3·77	12·80	5·26	44 54	„ 1	·71	39
3 E.	—	8·70	3·92	12·62	4·78	44 4	Mar. 2	·45	11
4 E.	—	8·55	3·87	12·42	4·68	48 8	„ 26	·33	0
5 E.	—	8·21	3·64	11·85	4·57	58 37	„ 15	·26	69
6 E.	—	8·05	4·48	12·53	3·57	52 59	„ 21	·22	−87

TABLE XVI.—Harmonic Constants for Mean Monthly Surface Temperatures, Harwich to Hamburg, 1906.

Longitude.	Latitude.	A_0.	A_1.	Mean Maximum.	Mean Minimum.	e_1.	Approximate date of Minimum.	A_2.	e_2.
°	° ′					° ′			°
				1906.					
3 E.	52 40 N.	9·86	5·65	15·51	4·21	43 45	Mar. 2	·37	1
4 E.	53 6 N.	10·10	5·81	15·91	4·29	48 55	Feb. 25	·30	11
5 E.	53 30 N.	10·40	6·28	16·68	4·12	53 40	„ 20	·44	28
6 E.	53 45 N.	10·08	6·53	16·61	3·55	55 36	„ 18	·36	3
7 E.	53 53 N.	9·69	6·72	16·41	2·97	56 14	„ 18	·43	8
8 E.	53 59 N.	9·53	6·78	16·31	2·75	54 31	„ 19	·45	−79
				1907.					
2 E.	—	9·41	6·51	15·92	2·90	45 0	Mar. 1	·15	−23
3 E.	—	9·47	5·90	15·37	3·57	43 29	„ 3	·42	21
4 E.	—	9·78	5·84	15·62	3·94	50 58	„ 23	·35	50
5 E.	—	9·77	6·25	16·02	3·52	56 41	„ 17	·26	46
6 E.	—	9·23	6·68	15·91	2·55	59 6	„ 15	·11	−15
7 E.	—	8·85	6·78	15·63	2·07	58 8	„ 16	·24	−22
8 E.	—	8·66	7·09	15·75	1·57	56 27	„ 18	1·04	−20

TABLE XVII.—Harmonic Constants for Mean Monthly Surface Temperatures at Continental Lightships.

Station.	Latitude.	Longitude.	Year.	A_0.	A_1.	Mean Maximum.	Mean Minimum.	e_1.	Approximate date of Minimum.	A_2.	e_2.
	° ′	° ′						° ′			° ′
Skaw Light Vessel.	57 46 N.	10 43 E.	1906	9·10	7·01	16·11	2·09	63 50	Feb. 10	·93	−55 58
			1907	8·30	6·31	14·61	1·99	58 33	„ 15	·49	9 29
Vyl Light Vessel.	55 23·6 N.	7 45 E.	1906	9·10	6·92	16·02	2·18	54 42	„ 19	·23	−74 45
			1907	8·70	6·59	15·29	2·11	52 43	„ 21	·57	19 42
Horns Reef Light Vessel.	55 34 N.	7 19·5 E.	1906	9·30	6·56	15·86	2·74	50 3	„ 24	·12	8 16
			1907	8·70	6·25	14·95	2·45	47 24	„ 27	·67	− 7 38

TABLE XVIII.—Harmonic Constants for Mean Monthly Surface Temperatures.
Leith to Hamburg.

Longitude.	Latitude.	A_0.	A	Mean Maximum.	Mean Minimum.	e_1.	Approximate date of Minimum.	A_2.	e_2.
°	° ′					° ′			°
				1906.					
2 W.	56 0 N.	8·84	4·00	12·84	4·84	44 24	Mar. 2	·62	76
1 W.	55 49 N.	9·06	4·27	13·33	4·79	44 7	„ 2	·83	59
0	55 37 N.	9·39	4·67	14·06	4·72	47 48	Feb. 26	1·06	41
1 E.	55 25 N.	9·48	4·84	14·32	4·64	49 5	„ 25	1·05	30
2 E.	55 12 N.	9·66	5·21	14·87	4·45	49 20	„ 25	·74	23
3 E.	55 2 N.	9·84	5·66	15·50	4·18	48 37	„ 25	·53	11
4 E.	54 49 N.	9·96	5·82	15·78	4·14	45 51	„ 28	·33	41
5 E.	54 38 N.	10·18	5·96	16·14	4·22	43 58	Mar. 2	·20	−35
6 E.	54 28 N.	10·28	6·27	16·55	4·01	45 16	„ 1	·13	−26
7 E.	54 16 N.	10·23	6·51	16·74	3·72	49 28	Feb. 25	·23	−20
8 E.	54 2 N.	9·85	6·97	16·82	2·88	53 27	„ 21	·21	38
				1907.					
2 W.	—	8·44	3·44	11·88	5·00	40 38	Mar. 5	·60	−18
1 W.	—	8·72	3·76	12·48	4·96	41 52	„ 4	·45	73
0	—	8·92	3·75	12·67	5·17	41 11	„ 5	·29	63
1 E.	—	9·01	3·90	12·91	5·11	44 53	„ 2	·35	25
2 E.	—	9·21	4·10	13·31	5·11	45 50	Feb. 28	·35	−26
3 E.	—	9·38	4·57	13·95	4·81	44 42	Mar. 1	·25	87
4 E.	—	9·34	5·00	14·34	4·34	41 56	„ 4	·38	39
5 E.	—	9·53	5·23	14·76	4·30	39 40	„ 6	·48	18
6 E.	—	9·55	5·61	15·16	3·94	43 54	„ 2	·49	18
7 E.	—	9·34	6·07	15·41	3·27	49 13	Feb. 24	·49	17
8 E.	—	9·20	6·46	15·66	2·74	51 10	„ 23	·73	29

TABLE XIX.—Harmonic Constants for Mean Monthly Surface Temperatures.
Newcastle to Bergen.

Longitude.	Latitude.	A_0.	A_1.	Mean Maximum.	Mean Minimum.	e_1.	Approximate date of Minimum.	A_2.	e_2.
°	° ′					° ′			° ′
				1906.					
1 W.	—	8·68	4·03	12·71	4·65	41 53	Mar. 4	·79	38 19
0	—	8·92	4·01	12·93	4·91	42 42	„ 3	·95	30 21
1 E.	—	8·99	3·98	12·97	5·01	42 40	„ 3	·89	20 29
2 E.	—	9·07	3·96	13·03	5·11	47 6	Feb. 27	·87	25 29
3 E.	—	8·99	4·13	13·12	4·86	58 48	„ 15	·76	32 00
4 E.	—	8·75	4·40	13·15	4·35	49 23	„ 24	·61	37 37
				1907.					
1 W.	—	8·82	3·52	12·34	5·30	42 14	Mar. 4	·56	54 2
0	—	8·76	3·43	12·19	5·33	40 9	„ 6	·49	30 58
1 E.	—	8·74	3·38	12·12	5·36	41 17	„ 5	·54	21 30
2 E.	—	8·76	3·57	12·33	5·19	41 36	„ 4	·54	20 26
3 E.	—	8·76	3·52	12·28	5·24	44 58	„ 1	·48	34 12
4 E.	—	8·78	3·51	12·29	5·27	45 57	Feb. 28	·36	48 3

TABLE XX.—Harmonic Constants for Mean Monthly Surface Temperatures.
The Forth to Aalesund.

Longitude.	Latitude.	A_0.	A_1.	Mean Maximum.	Mean Minimum.	e_1.	Approximate date of Minimum.	A_2.	e_2.
°	° ′					° ′			°
				1906					
1 W.	35 30 N.	9·08	3·15	12·23	5·93	45 56	Feb. 28	·39	66
0	58 20 N.	9·01	3·25	12·26	5·76	49 27	„ 25	1·00	45
1 E.	59 10 N.	8·96	3·13	12·09	5·83	48 57	„ 25	·85	32
2 E.	60 0 N.	8·97	3·27	12·24	5·70	49 47	„ 24	·92	42
3 E.	60 45 N.	9·06	3·35	12·41	5·71	48 28	„ 26	·92	62
4 E.	61 33 N.	8·82	4·22	13·04	4·60	45 9	Mar. 1	·94	51
				1907.					
2 W.	56 40 N.	8·65	3·32	11·97	5·33	36 40	Mar. 9	·01	31
1 W.	57 30 N.	8·77	2·75	11·52	6·02	37 55	„ 8	·30	80
0	58 20 N.	8·61	2·62	11·23	5·99	41 50	„ 4	·38	77
1 E.	59 10 N.	8·49	2·73	11·22	5·76	40 59	„ 5	·41	77
2 E.	60 0 N.	8·64	2·49	11·13	6·15	46 14	Feb. 28	·39	72
3 E.	60 45 N.	8·53	2·07	10·60	6·46	46 19	„ 28	·48	87
4 E.	61 33 N.	8·61	3·11	11·72	5·50	42 40	Mar. 3	·35	50

TABLE XXI.—Harmonic Constants for Mean Monthly Surface Temperatures.
The Forth to Stavanger.

Longitude.	Latitude.	A_0.	A_1.	Mean Maximum.	Mean Minimum.	e_1.	Approximate date of Minimum.	A_2.	e_2.
°	° ′					° ′			°
				1906.					
2 W.	56 22 N.	8·38	3·59	11·97	4·79	29 8	Mar. 17	·39	47
1 W.	56 44 N.	8·53	3·59	12·12	4·94	35 35	„ 10	·70	42
0	57 6 N.	8·89	3·80	12·69	5·09	38 36	„ 7	1·14	30
1 E.	57 27 N.	9·01	3·75	12·76	5·26	39 39	„ 6	1·21	35
2 E.	57 48 N.	9·00	3·88	12·88	5·12	40 47	„ 5	1·40	37
3 E.	58 8 N.	9·05	4·16	13·21	4·89	47 18	Feb. 27	1·45	44
4 E.	58 29 N.	8·75	4·96	13·71	3·79	48 25	„ 26	1·52	40
5 E.	58 49 N.	8·47	5·56	14·03	2·91	49 22	„ 25	2·19	42

TABLE XXII.—Harmonic Constants for Mean Monthly Surface Temperatures.
Hamburg to Bergen.

Latitude.	Longitude.	A_0.	A_1.	Mean Maximum.	Mean Minimum.	e_1	Approximate date of Minimum.	A_2.	e_2.
° ′	° ′					° ′			° ′
				1907.					
55 N.	7 36 E.	8·96	6·29	15·25	2·67	53 5	Feb. 21	·66	44
55 30 N.	7 26 E.	9·12	6·09	15·21	3·03	49 56	„ 24	·32	−16
56 N.	7 16 E.	8·77	5·48	14·25	3·29	39 23	Mar. 7	·21	−72
56 30 N.	7 6 E.	8·88	5·27	14·15	3·61	38 55	„ 7	·12	69 50
57 0 N.	6 55 E.	8·58	4·60	13·18	3·98	35 54	„ 10	·39	−86
57 30 N.	6 43 E.	8·23	4·48	12·71	3·75	44 38	„ 2	·28	58
58 N.	6 30 E.	7·66	4·67	12·33	2·99	44 49	„ 1	·17	−35

TABLE XXIII.—Harmonic Constants for Mean Monthly Surface Temperatures. Ostende to Tilbury Dock.

Longitude.	Latitude.	A_0.	A_1.	Mean Maximum.	Mean Minimum.	e_1.	Approximate date of Minimum.	A_2.	e_2.
° ′	° ′					° ′			° ′
				1907.					
1 E.	51 30 N.	10·27	6·30	16·57	3·97	64 8	Feb. 10	·29	69 41
1 30 E.	51 30 N.	10·13	5·90	16·03	4·23	51 33	„ 23	·32	33 26
2 E.	51 24 N.	10·34	5·81	16·15	4·53	44 31	Mar. 20	·46	24 21
2 30 E.	51 20 N.	10·51	6·29	16·80	4·22	51 40	Feb. 22	·56	33 42
2 50 E.	51 16 N.	10·35	6·78	17·13	3·57	62 52	„ 11	·49	64 19

TABLE XXIV.—Harmonic Constants for Mean Monthly Surface Temperatures. Copenhagen to Pentland Firth.

Longitude.	Latitude.	A_0.	A_1.	Mean Maximum.	Mean Minimum.	e_1.	Approximate date of Minimum.	A_2.	e_2
°	° ′					° ′			° ′
				1907.					
8 E.	57 52 N.	9·13	4·90	14·03	4·23	45 45	Feb. 28	1·71	−18 26
7 E.	57 58 N.	8·68	4·54	13·22	4·14	46 26	„ 28	1·78	−25 59
6 E.	58 3 N.	8·25	4·58	12·83	3·67	54 31	„ 19	·95	−36 2
5 E.	58 8 N.	8·19	4·33	12·52	3·86	50 4	„ 24	·89	−45 12
4 E.	58 12 N.	8·20	3·88	12·08	4·32	45 31	„ 28	·68	−70 14
3 E.	58 17 N.	8·36	3·49	11·85	4·87	45 7	Mar. 1	·66	−79 58
2 E.	58 21 N.	8·47	3·26	11·73	5·21	43 8	„ 3	·69	88 21
1 E.	58 25 N.	8·42	3·04	11·46	5·38	39 24	„ 7	·80	85 12
0	58 28 N.	8·50	2·72	11·22	5·78	40 14	„ 6	·56	80 12
1 W.	58 32 N.	8·68	2·44	11·12	6·24	43 31	„ 2	·33	−80 12
2 W.	58 36 N.	8·75	2·29	11·04	6·46	42 12	„ 4	·15	−32 13

The values obtained for the mean annual temperature (A_0) during 1906 and 1907 have been charted, and the corresponding isotherms drawn.

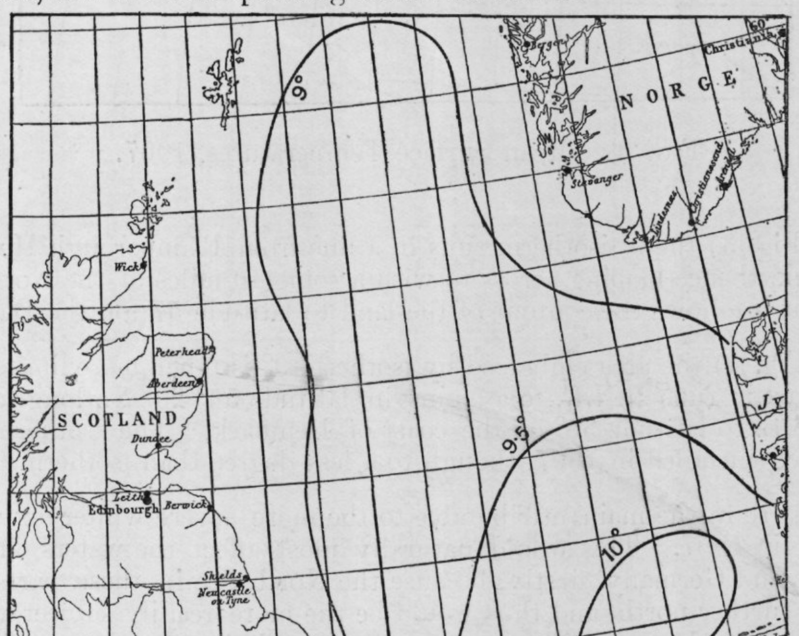

FIG. 3. Mean Surface Temperatures, 1906.

A glance at these two maps shows that during 1907 the mean surface temperature over the whole North Sea area was much lower than it was in the preceding year.

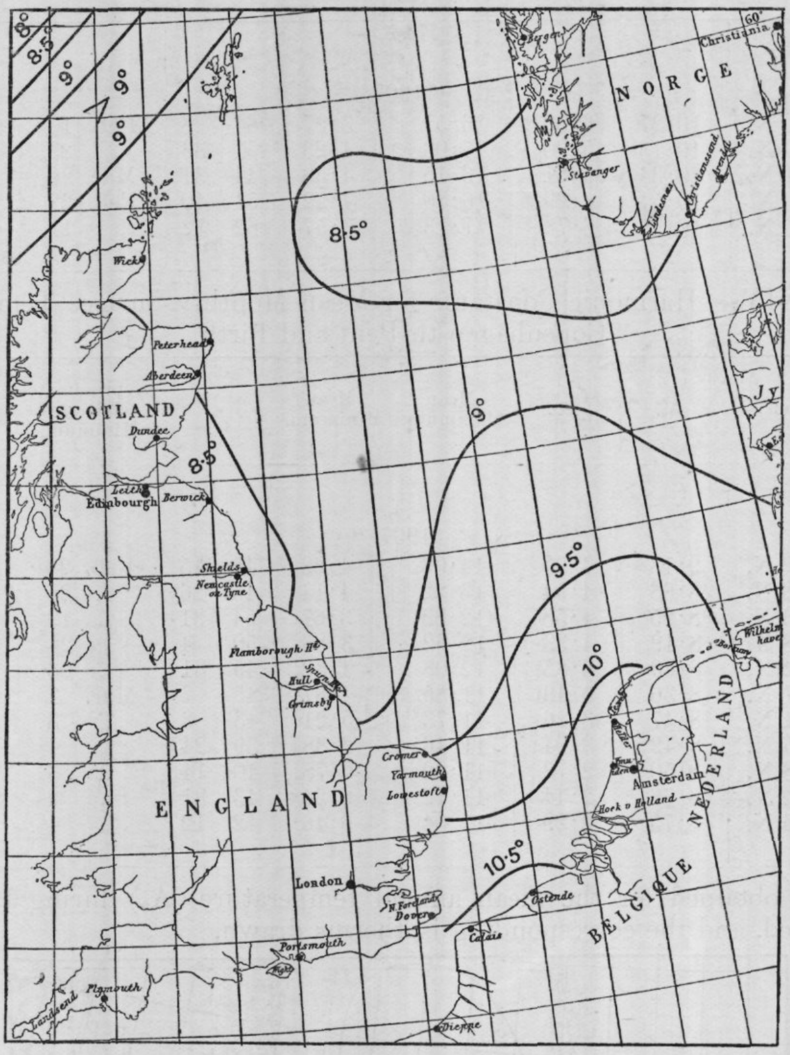

FIG. 4. Mean Surface Temperatures, 1907.

In 1906 (Fig. 3) the 9° isotherm runs in a line from Flamborough Head almost due north to Lerwick, thence looping across to within some 40 miles of the Norwegian Coast, from which point it follows the contour of the land to latitude 57° on the Danish seaboard.

In 1907 (Fig. 4) the area embraced by isotherm 9° is much more limited. From the Lincolnshire coast it runs N.N.E. to a point in latitude 56° 20′ N., longitude 4° E., and thence nearly S.E. to latitude 55° on the coast of Denmark. The isotherms of 9·5° and 10° are also much curtailed in 1907, though to a less degree than isotherm 9°.

These facts are in the main attributable to the more severe winter experienced over western Europe in 1907. This would naturally most affect the waters off the coasts of the Netherlands and Germany, firstly, because the North Sea in these parts is shallower than is the case further north, and thus would be the more readily subject to fluctuations in the temperature of the atmosphere; secondly, the diminution during 1907 would be more noticeable off the continental shores on account of the relatively larger proportion of cold fresh water passed into the sea by the rivers of Germany in contradistinction to the comparatively small amount poured into the deeper parts of the North Sea by the less voluminous east coast rivers of Britain.

For these reasons, then, we find that yearly differences of temperature are greater and more extreme in the southerly portions of the North Sea. This fact is borne out by the observations for the two years; for while we have seen that on the Harwich–Hamburg route we had large differences in the mean minimum temperature for the two years under consideration, on the Leith–Christiansand route the differences were much less.

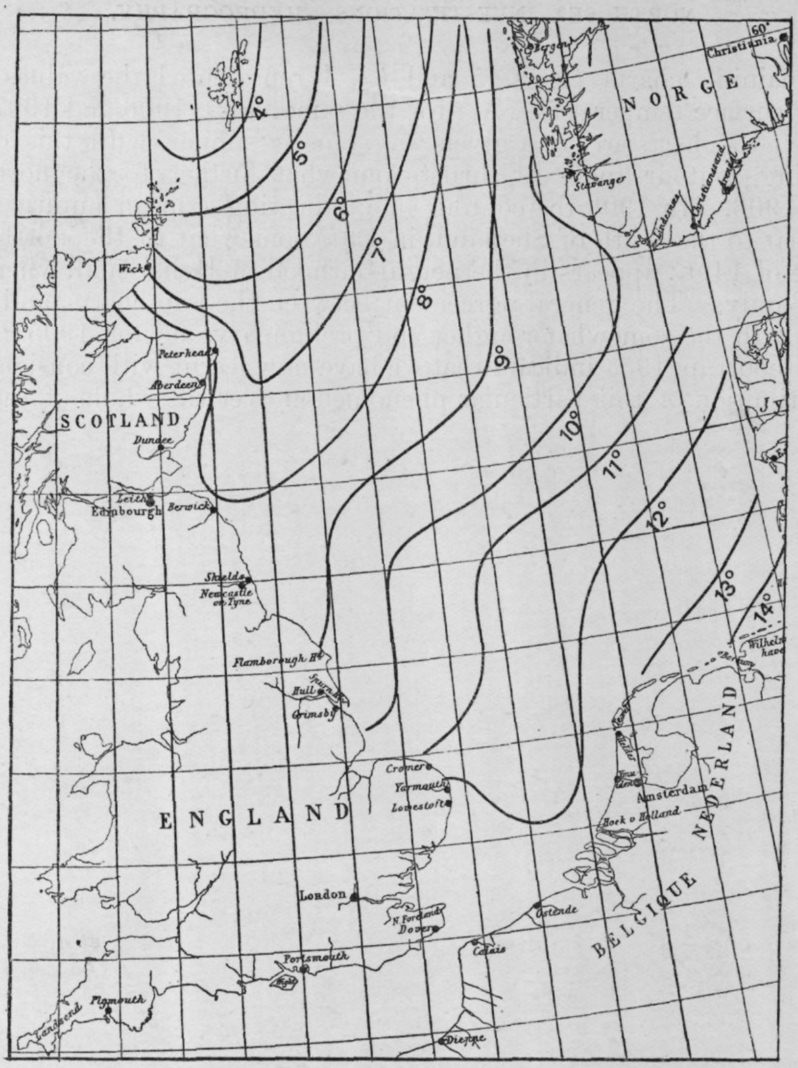

FIG. 5. Mean Range of Surface Temperature, 1906.

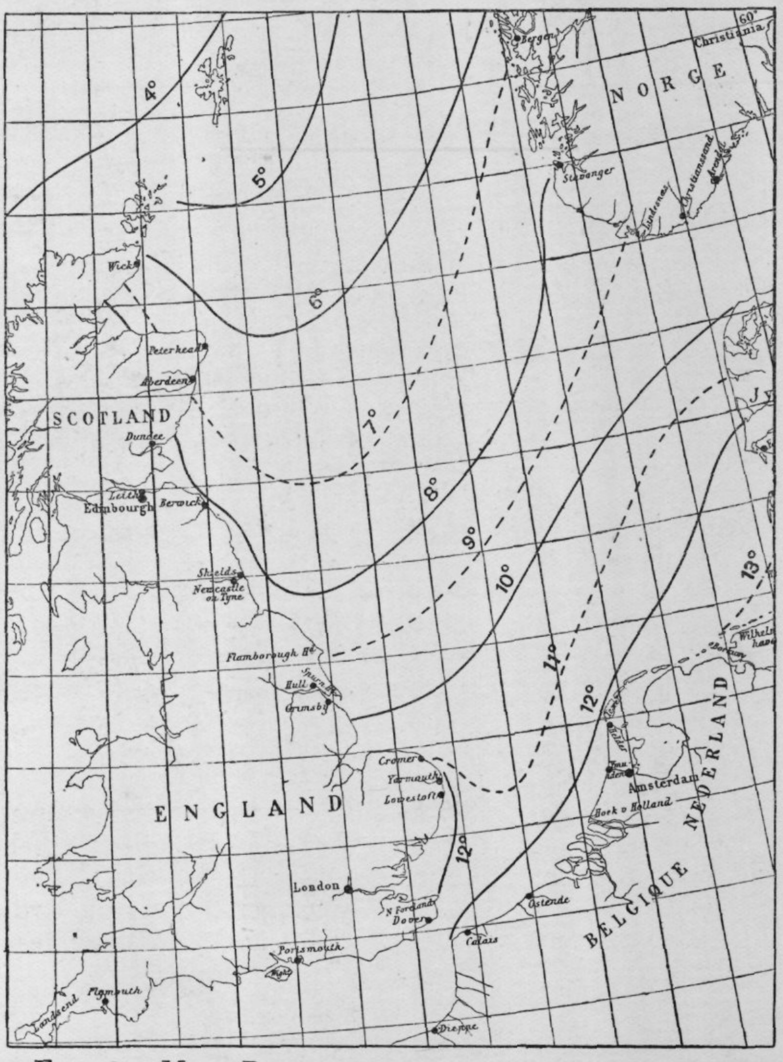

FIG. 6. Mean Range of Surface Temperature, 1907.

In the remaining charts (Figs. 5 and 6), I represented the values for the mean annual range of surface temperature (A_1) for the same years, 1906 and 1907. It will be seen that these two charts are, in a given way, closely similar, with this difference, that the corresponding contour lines are thrust somewhat further to the north in 1907 as compared with 1906. In 1906 the contour line indicating a mean annual range of 4° C. appears somewhat to the south of Shetland, in 1907 somewhat to the north thereof; and in 1906 a range of 14° C. appears in the neighbourhood of Heligoland, where the chart for 1907 shows 13° only. The general agreement between the two charts, and their general correspondence with the somewhat rougher and preliminary one for 1905 (already given in our Second Report, p. 195) indicate that we have now learnt with considerable accuracy the normal distribution of this particular phenomenon over the whole of the North Sea.

REPORT

ON

THE SALINITY OF THE NORTH SEA.

BY

D'ARCY WENTWORTH THOMPSON.

CONTENTS.

REPORT

ON

THE SALINITY OF THE NORTH SEA.

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D'ARCY WENTWORTH THOMPSON.

1. In a former volume of these Reports an attempt was made to give a general account of the temperature phenomena over the greater part of the North Sea. We found it possible to prepare charts showing (1) the mean annual temperature of the surface waters, (2) the mean annual variation of temperature, (3) the mean maximal and minimal temperatures attained in the course of a year, and (4) the dates or seasons at which these maxima and minima occurred. The corresponding phenomena for various depths below the surface can be, and have in part been, described and illustrated. It is now time to attempt, in a similar fashion, to discuss the variations in salinity over the North Sea, at least in so far as we can reduce them to their mean annual values.

2. In the study of temperature we found our work greatly facilitated by making use of the assumption that the annual periodic changes of temperature at any given locality corresponded very closely to a simple sine-curve. In the case of salinities we have no right to make use of this assumption, for want of any obvious physical factor to justify it ; and, as a matter of fact, while the annual variation of salinity does often yield us a curve that closely resembles a simple curve of sines, yet on the other hand this annual periodic curve is often of a very different form ; for often a period of minimal salinity quickly follows a period of maximum and is followed in turn by a long and gradual ascent, and a south maximum and minimum within the year is also a not infrequent occurence in some regions.

The method by which our data are arrived at is a simple one. Where our observations are limited to those of the quarterly cruises we have simply taken the arithmetic mean of all the extant observations to be the mean salinity at the given station. Where our observations are more numerous, as in the Scottish area, but at somewhat irregular dates, we have drawn a continuous curve by interpolation, and have averaged the monthly values of the interpolated curve. In the next place, with varying success according to the number of observations available, we have taken mean values for corresponding dates in the successive years (1902-1907), and have connected these by interpolated curves, which are very generally sufficient to give us a first approximation to the form of the annual wave, to its amplitude or range of variation, and to the date or season of maximum and minimum salinity.

THE MEAN DISTRIBUTION OF SALINITY.

3. In the annexed chart (Fig. 1.) are laid down lines, or "isohalines," which correspond to points or places of equal salinity. The main features of the map are extremely simple. By far the lowest salinities are found in the innermost parts of the Skager Rack, where we have drawn lines of gradually decreasing salinity down to the value of $25^\circ/_{\circ\circ}$, that is to say of 25 parts by weight of salts in one thousand parts of water. From this comparatively low value we should go on rapidly decreasing, had we continued this region of the chart, until we reached the brackish, or all but fresh, waters of the inner Baltic.

In two parts of our chart we find maximal salinities, namely at the two entrances to the ocean, formed by the Straits of Dover and the Shetland Seas. In the former we find mean surface salinities of about $35{\cdot}2^\circ/_{\circ\circ}$, but such water is in very small amount, just peeping, as it were, through the Straits into the North Sea. The Shetland Islands are bathed in water of a mean salinity of $35{\cdot}25^\circ/_{\circ\circ}$, while immediately beyond them, through the Faeroe Channel, there runs in a narrow band a branch of the so-called Gulf Stream, with a salinity exceeding $35{\cdot}3^\circ/_{\circ\circ}$.

Around the coasts the salinities are everywhere comparitively low, and the isohalines form a system of curves that are always convex towards the oceanic outlets. The

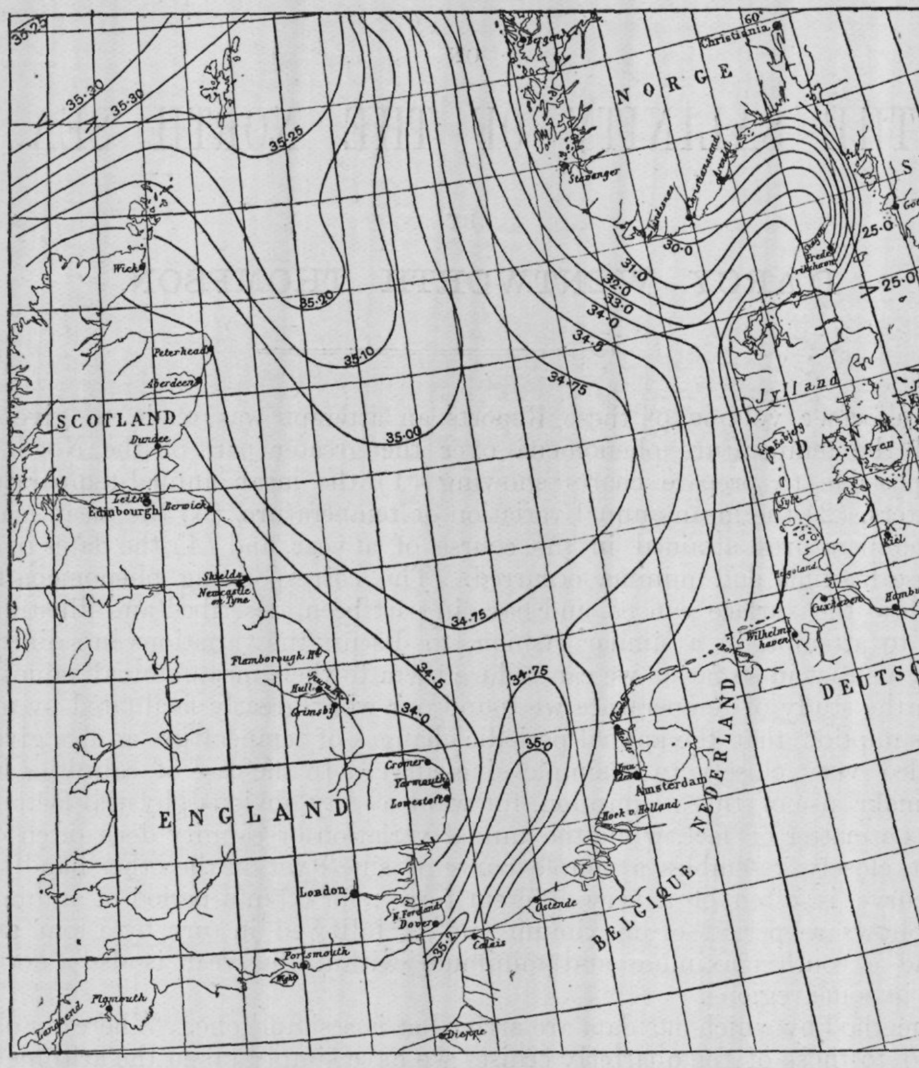

FIG. 1.—Mean surface salinity of the North Sea, 1903–7.

isohalines represented in the map do not in all cases correspond to equal increase or diminution of salt, but, as will be readily seen, are drawn at more frequent intervals in the higher values ; and, bearing this in mind, it will be seen how much more closely packed are the isohalines where they are most remote from the ocean, and how comparitively wide apart they lie where the salinity increases towards the oceanic level.

The general distribution and form of the curves of equal salinity upon the chart may be the more easily explained and understood if we think of the somewhat parallel case of the flow of heat, or of electricity, in a bar of metal, and consider the distribution of temperature, or of potential, that will arise. If we take a long bar of metal heated at one end (as in Forbes' classical experiments) and ascertain its temperature at various points when a steady flow of heat by conduction has been set up, we find that the temperature falls from one end of the bar to the other, and (since the rate of cooling is proportional to the temperature excess over the surroundings) it falls slower and slower as we pass from the heated end ; in other words, we find a falling series of isotherms, running transversely to the 'thermal axis' of the bar, and ranging themselves in a logarithmic series (corresponding, in general terms, to $\frac{dy}{y} = \lambda dx$), at increasing distances from the source of heat towards the cooler end. If, in the next place, we imagine that heat is supplied not only at one end but also at the sides or edges of the bar, then the isothermal lines, instead of being straight lines at right angles to the axis, will become curved, with their concavities turned towards the cooler end. Lastly, if we imagine our bar to be no longer narrow, but broadened out into something like a square, and the sources of heat and cold to be no longer opposite but on two adjacent sides of the square, then the thermal axis will be bent into a curve, its two extremities becoming perpendicular to one another, and the curved isotherms will be closely packed towards the concave side of the bent axis, and more widely spaced upon its convex or outer side. If now, in looking at our chart of surface salinity in the North Sea, we omit for the moment the slight complication introduced by the communication with oceanic water at the Straits of Dover, then the system of isohalines will be sure to correspond closely to the system of isotherms in a piece of metal under the last-named conditions. A bent axis may be traced from the main inlet of fresh water in the Skager Rack, passing through the middle of the North Sea, and ending in the Atlantic water to the east and north of the Shetlands; this axis is crossed by a series of isohalines, that stand more and more widely asunder as we approach the ocean; the additional influx of fresh water from the coasts bends these isohalines into curves that are in a general way concave towards the ocean, and approximately parallel to the coast lines; the isohalines are closely packed along the Norwegian coast, but are more divergent on the other side of the axis, the side of greater curvature. One further point remains: the whole system of higher isohalines, those that is to say in the neighbourhood of the oceanic outlet, is markedly shifted over towards the west, and lies much nearer to the Scottish than to the Norwegian side. This phenomenon is doubtless contributed to by more causes than one. In the first place the oblique north-easterly direction of the Gulf Stream current places the saltest water of this part of the ocean nearer to the Shetland side than to the Norwegian; secondly, the influx of fresh water from the coast is undoubtedly greater on the Norwegian than on the Scottish side; and thirdly, though this is a matter which we are not at present in a position to discuss, there would seem to be something of the nature of a south-flowing current, of low temperature and salinity, in the neighbourhood of the Norwegian coast.

From the Cattegat to the Skager Rack, around the Skaw, the axis is bent in a contrary direction to that in the North Sea; we are dealing in short with a sort of tube narrow at one end (in the Cattegat) and broad at the other (towards the ocean), and bent at the same time into a S-shaped twist. Though we have not drawn the isohalines throughout the Cattegat, yet we see that at its mouth they are closely packed in the neighbourhood of the Skaw, or on the side of the lesser curvature, and diverge as they approach the Swedish and Norwegian coasts, along, what is here, the greater curvature of the bent tube. The axis is again shifted over to one side, in this case towards the Danish one; and sufficient reason for this phenomenon may be found, not only in the greater inflow of fresh water from the Swedish and Norwegian coasts than from the Danish, but also in the natural tendency of the outgoing current from the Cattegat to incline towards the outer bank of the curved channel. The general arrangement of the curves in the Skager Rack is therefore quite comparable, on a smaller scale and with closer packing, to that which we have found in the region between Scotland and the west coast of Norway.

Returning for a moment to the salinites actually indicated on the chart, we see that in no part of the surface of the North Sea (save in the immediate neighbourhood of Shetland) does the mean salinity exceed $35{\cdot}25°/_{oo}$; that the greater part of the whole North Sea is covered by water of a salinity from $34{\cdot}75°/_{oo}$ to $35{\cdot}25°/_{oo}$; that towards the coasts the salinity falls off rapidly, and in much greater degree towards the continental than towards our insular coast; so much so that the North Sea coast of Norway, Denmark and Germany are washed by water whose mean salinity is less than $32{\cdot}0°/_{oo}$.

4. If we turn now to the chart representing the mean annual salinity at the bottom (Fig. 2) we see that, subject to certain differences, the general arrangement of the curve of equal salinity is similar to that of the surface. It must be remembered that this diagram is no longer drawn to a single plane, as was the former one, but follows the varying depth of water; it represents in a general way a plane, shelving from the shallow southern portions of the North Sea towards the deep waters of the north, and towards the deep channel that runs down the Norwegian coast and into the Skager Rack.

We notice in the first place the now well-known phenomenon that in the whole southern portion of the North Sea, from the Dogger Bank southwards, the curves of salinity at the bottom are all but identical with those of the surface; the comparative shallowness of this portion of the sea, and the extent to which it is constantly mixed up by wave-motion and tidal current, are sufficient to explain this condition. Elsewhere the differences between the surface and bottom phenomena are of a simple kind. Everywhere there is an appreciable excess of salinity at the bottom, and in the deep waters of the Skager Rack and off the Norwegian coast the discrepancy is very great. Where our chart begins in the northern part of the Cattegat, the bottom waters have already a salinity of $34°/_{oo}$, where that of the surface waters is less than $25°/_{oo}$. Along the main channel of the Skager Rack the salinity is over $35{\cdot}1°/_{oo}$, or within $\cdot 2°/_{oo}$ of the saltest water with which we have to deal anywhere in our region. The axis perpendicular to the isohalines is no longer shifted over to the Danish coast in the region of the Skager Rack, nor to the same extent as before in the region between Scotland and Norway; and

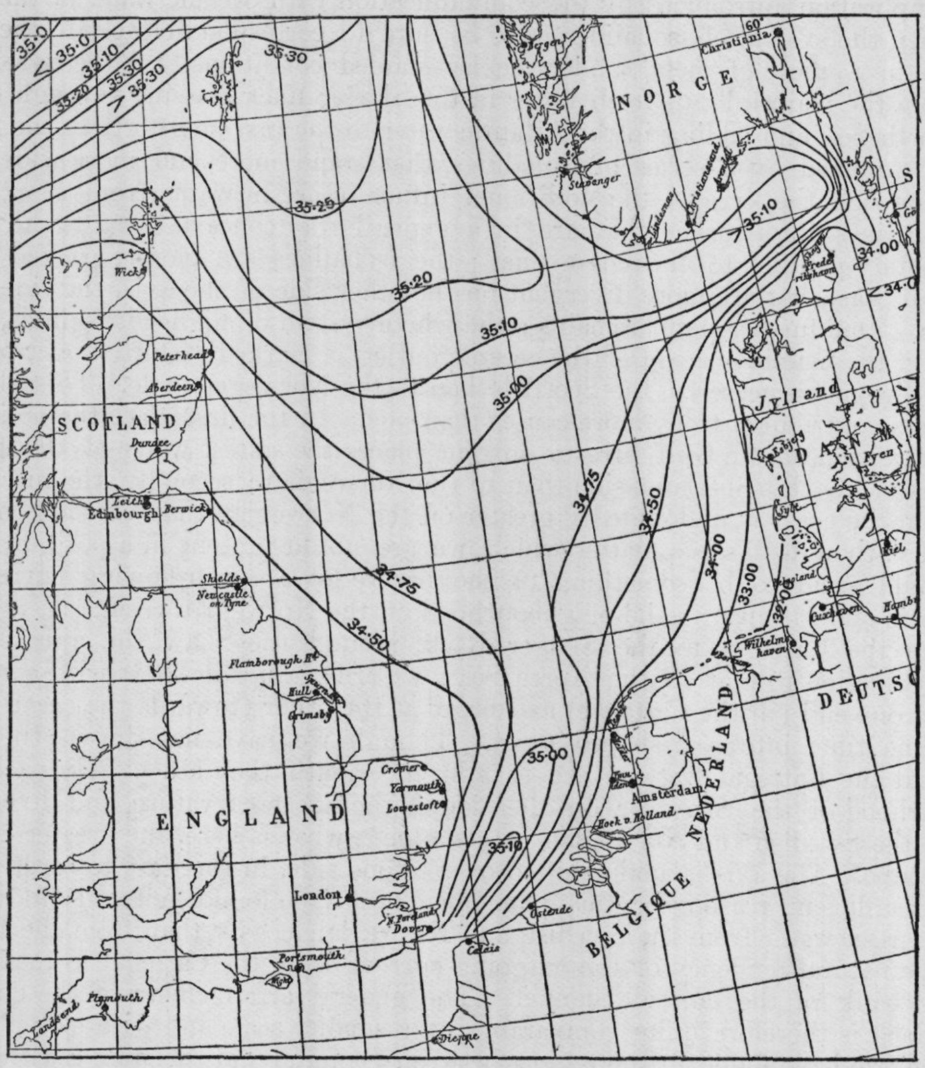

FIG. 2.—Mean salinity of the North Sea at the bottom, 1903–7.

while in the latter case its position is accounted for by the contour of the bottom, the former case reminds us that the westward shift was due to the special conditions of surface inflow, as well as to the distribution of salinity in the oceanic waters beyond.

Looking in a general way at the salinities of the bottom water, we see that over the whole of the North Sea the differences are comparatively small. Northward of the latitude of Aberdeen the bottom of the North Sea has everywhere, save in the near neighbourhood of the coast, a salinity of from $35{\cdot}1^{\circ}/_{\circ\circ}$ to $35{\cdot}3^{\circ}/_{\circ\circ}$. Only in the German Bight, or angle of sea between the Danish and the Frisian coasts, do we find a stretch of water that rapidly falls from $34^{\circ}/_{\circ\circ}$ to about $32^{\circ}/_{\circ\circ}$ of salinity.

While similar charts have been drawn for depths of 50 and 100 meters, it does not seem necessary to reproduce them here, for the reason that they bring to light no important features that cannot readily be deduced from the main charts of surface and bottom conditions.

5. It is of interest to examine, by the help of another form of diagram, the rate of change of salinity from one part of the sea to another. In Fig. 3 I have attempted to represent the varying salinity, at the surface and at the bottom, along a line drawn from the north of Shetland to Borkum, that is to say from the north to the south of the North Sea. The salinity at the bottom here falls into a very even curve, showing, as our chart did, a very slow diminution of salinity in the north, a gradually increasing one in the middle of the North Sea, and a rapid drop in the neighbourhood of the continental coast.

This curve is only diagrammatic, firstly because of the scale on which it is drawn, which has led to the crowding together of the descending portions of the curve, and secondly because, within the region of rapidly diminishing salinity, our observations are extremely few, and we really know very little about the actual rate of decrease in the neighbourhood of the shore. Nevertheless, the main facts are clear. The phenomenon with which we are dealing is not, technically speaking, one of simple diffusion, but of diffusion aided and immensely accelerated by gradual or piecemeal mixing from point to point over a large area. Molecular diffusion is as inadequate to produce the observed progressive changes in salinity throughout the waters of the sea, as is conduction of heat to produce the observed changes in temperature; but mixture, or convertion of small masses, produces in both cases a result very similar in regard to its ultimate distribution to what would have been attained under the strict laws of diffusion and conduction. In the end we have at one end the comparatively fresh coastal waters (more or less intermittently replenished), and at the other end the all but uniform dead level of oceanic salinity. Under these circumstances the gradient of salinity may be treated as infinite at the one end and zero at the other; in other words, as we have actually found, there is an extremely rapid rise in salinity from the coast outwards, and then a slower and slower increase till we reach the ocean.

In the same diagram (Fig. 3) it will be seen that the curve of salinity for the surface waters is identical with that for the bottom waters from the region of the Dogger Bank southwards, as indeed has already been shown to be the case; and again the two curves are not perceptibly different towards the extreme north of our area. Midway, however,

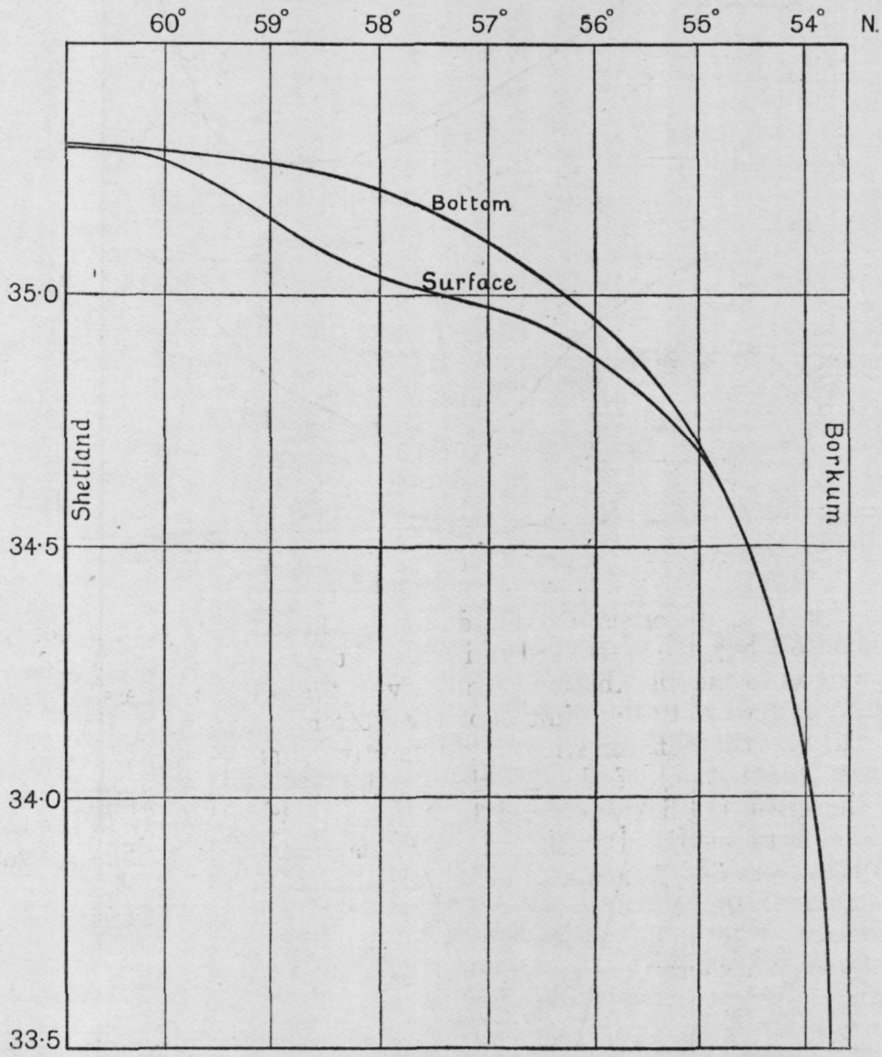

FIG. 3.—Diagram showing mean salinity, at surface and at bottom in the North Sea along a line from Shetland to Borkum.

the surface salinity is considerably lower, and its curve takes a downward bend; this difference, as we may see by reference to the charts, is due to the simple fact that the line from Shetland to Borkum cuts the deep isohalines more nearly at right angles than the surface ones, the latter having been deflected in a greater degree towards the Scottish coast.

The Mean Periodic Variation of Salinity.

6. When, as is usually the case, we find that the mean salinity from our quarterly and other cruises during several years furnishes us, at any one station, with a smooth

annual curve, we accept this as evidence and as the measure of a mean periodic variation. The underlying periodic variation is no doubt complicated by unperiodic variability, but the mean of five years' observations seems to be sufficient to give us a first approximation to a measure of the periodic pnenomenon. It is not sufficient to give it us with great accuracy, and especially is it inadequate (taking into account the small number of observations in each year) for the precise determination of the phase of the periodic wave, that is to say, of the mean annual epochs of maximum and minimum salinity.

The following are some examples of the mean curves that we obtain by interpolating between the observations, and by averaging the results of successive years.

In Fig. 4 we have the annual curve of salinity for stations Sc. 41*a*, 41*c*, 44 and 46, along the line from near the middle of the North Sea to the Firth of Forth.

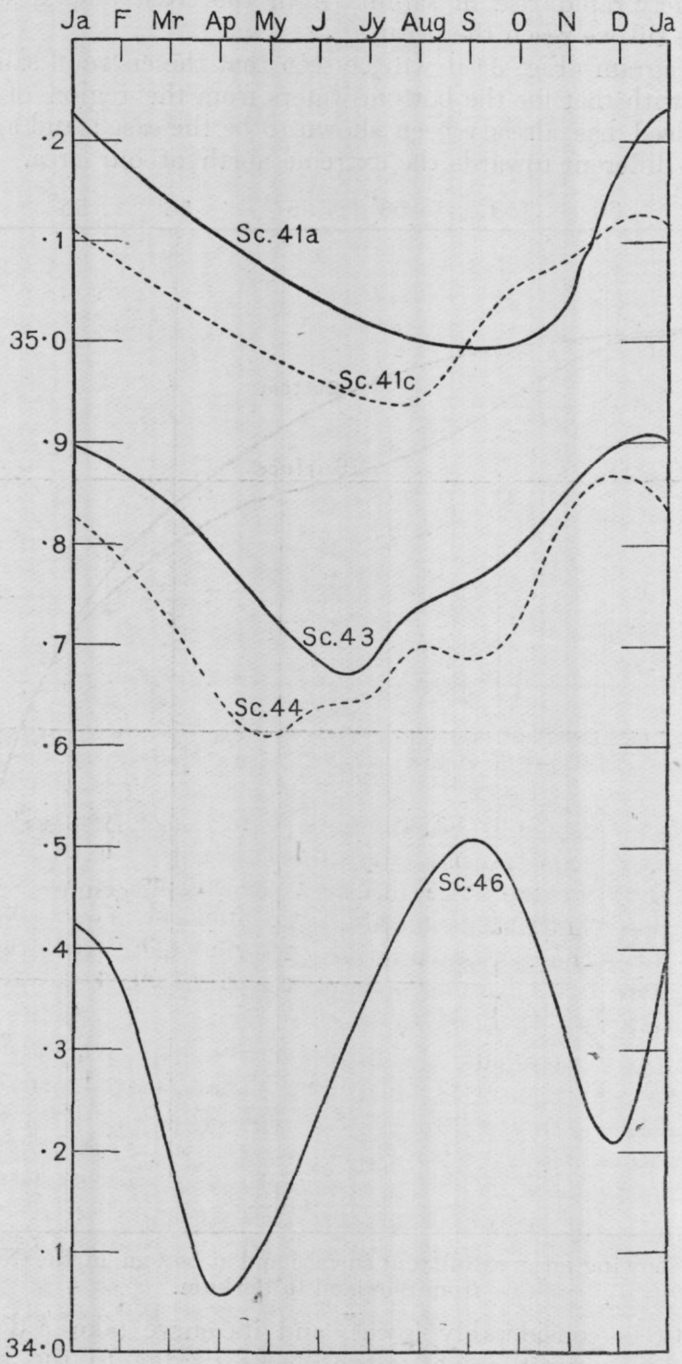

FIG. 4.—Mean annual curves of salinity (1903–7) at the surface, for five Scottish stations, from the Firth of Forth eastward.

We see here (1) that the mean salinity falls from station to station as we approach the coast, the fall being great between Sc. 44 and 46, just at the mouth of the Firth of Forth: (2) that the range of variation (or amplitude of the curve) increases as we come coastward, slowly at first, rapidly between Sc. 44 and 46: (3) that in all cases there is a maximum of salinity about the months of December or January, to which, at Sc. 46, another maximum in autumn is superadded: (4) that the date of minimum salinity shows signs of a progressive alteration in date, appearing later and later in the year as we pass from the coast seaward.

In Fig. 5 we show the corresponding curves for a group of stations (Sc. 5, 6 and 12) in the neighbourhood of Shetland, and for one station (Sc. 34), eastward of the Moray Firth.

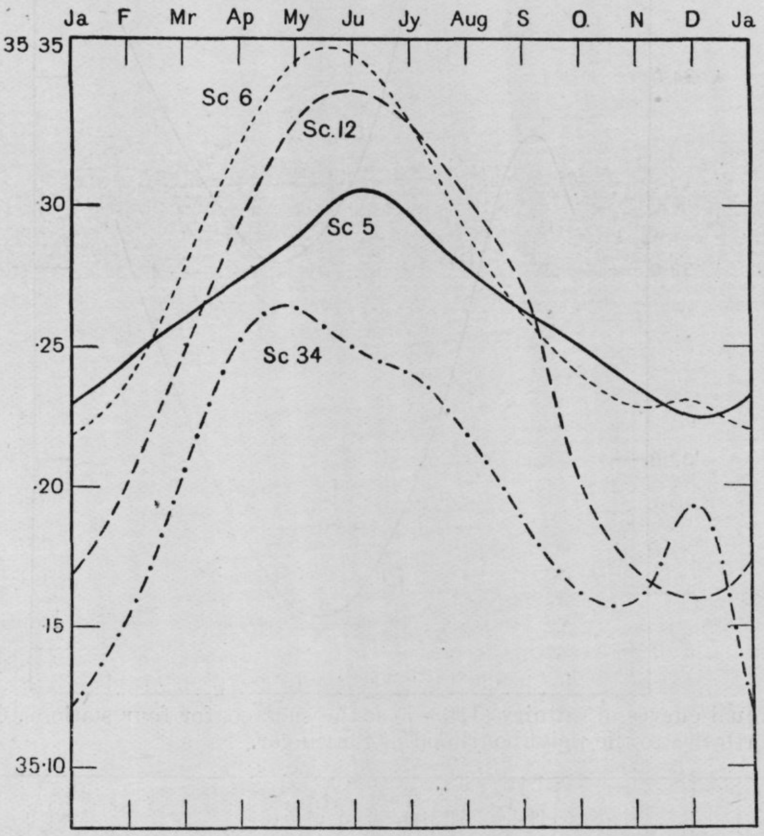

FIG. 5.—Mean annual curves of salinity, 1903–7, at the surface, for four Scottish stations in the neighbourhood of Shetland and (Sc. 34) eastward of the Moray Firth.

In all of these the period of maximum salinity is very different from the stations, in the former group, and occurs from May to June, or a little earlier in the case of Sc. 34. In the last named station there is evidence of a secondary maximum in December, which we may explain by supposing that this station is influenced to some extent by the phenomena that characterise the former, more southern, line. The smallest range is seen at Sc. 5, which lies in the Fair Isle Channel, and the highest mean at Sc. 6, which lies in the salt Atlantic water eastward of Shetland.

Passing to the eastern side of the North Sea we have in Fig. 6 the curves for a number of German stations, of which D 4 is not very far remote from our Scottish station Sc. 41A (already represented in Fig. 4), while D 6 and D 7 approach the Norwegian coast in the direction of Stavangar. Taking note of the different scale on which this figure is drawn compared with Fig. 4, we see that the range at D 4 is not very different to that at Sc 41A; and though the season of maximum is a little later, the general features are much the same, namely a maximum in late winter and a minimum in the summer and autumn months. At Stations D 6 and D 7 the same phenomena occur in an exaggerated form. The range of variation is now comparatively enormous, and the contrast is great between the high salinities in winter and early spring and the low salinities of summer and autumn; at D. 7, which lies nearest to the Norwegian coast, the mean salinity is markedly lower, and the phase is distinctly earlier than at D. 6. The same figure contains the curve for D. 3, which lies in the middle of the North Sea, in about 56° N. 3° E.; it is clear that we have in this case a striking likeness, though with higher mean and diminished range, to the curves for D. 6 and D. 7.

In Figs. 7 and 8 I have attempted to lay down the mean annual periodic variation in salinity at the surface and at the bottom.

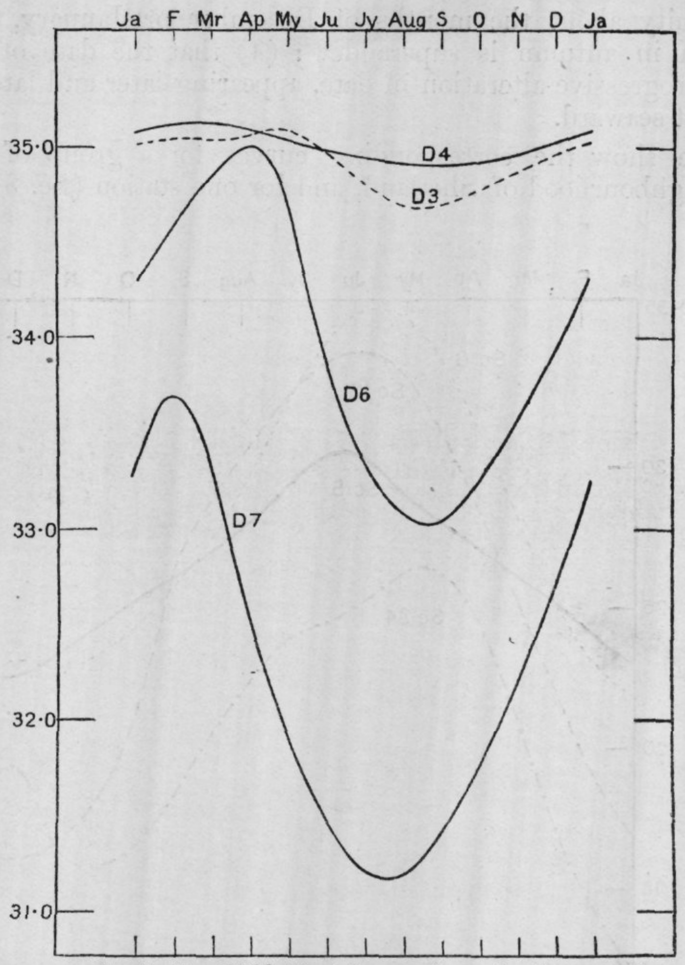

Fig. 6.—Mean annual curves of salinity (1903–7) at the surface, for four stations, from the middle of the North Sea to the neighbourhood of Stavangar.

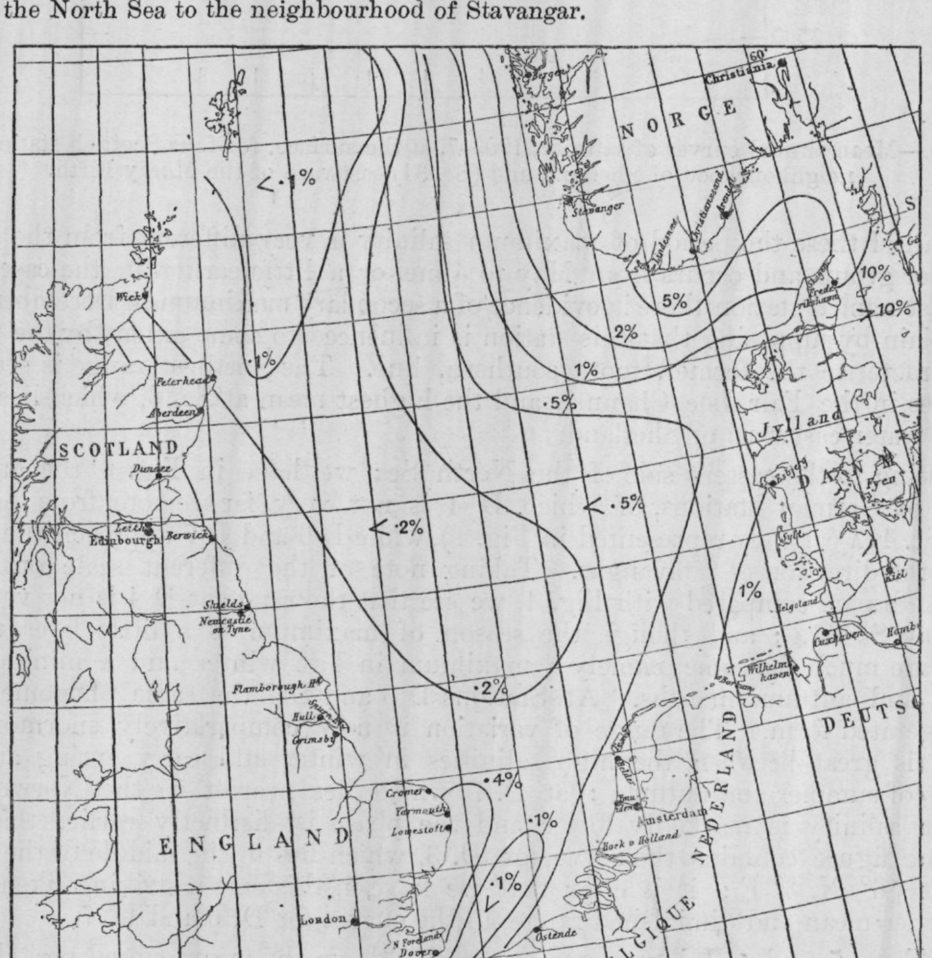

Fig. 7.—Mean annual variation of salinity (per mille) at the surface of the North Sea, 1903–7.

The general direction of these curves is on the whole similar to that of the isohalines in the former charts: for we find that where the mean salinity is highest, it is also least

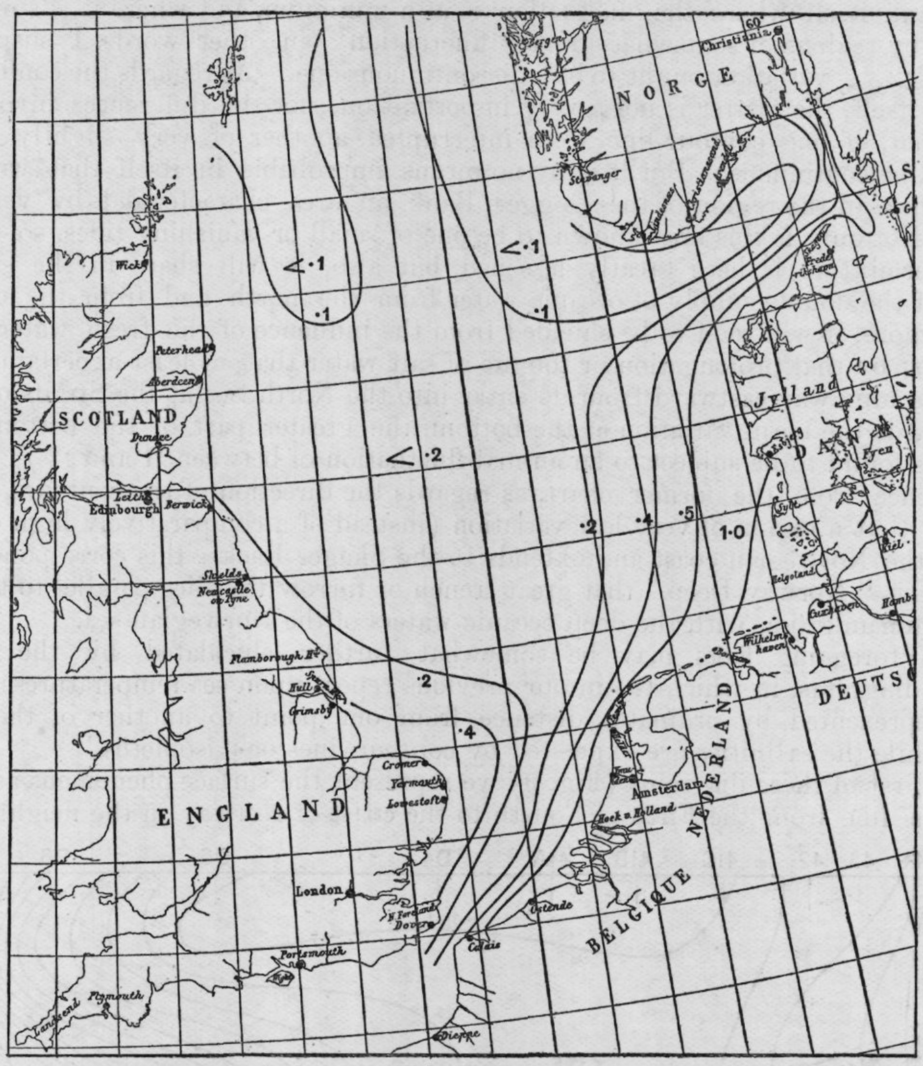

FIG. 8.—Mean annual variation of salinity (per mille) at the bottom, 1903–7.

subject to variation. This is as much as to say that such changes in salinity as take place in the neighbourhood of the ocean, and are due to the influence of the ocean, are far less in magnitude than those that take place owing to changes in the fresh-water supply; and this follows as a simple corollary from the relations diagrammatically shown in Fig. 3.

Considering the surface chart, we see that in the two regions where the North Sea communicates directly with the Atlantic, namely, at the Straits of Dover and in the neighbourhood of Shetland, the annual variation in salinity is less than ·1 gram of chlorides in one thousand grams of water, or in the 35·25 grams of chlorides that that water approximately contains. In the Straits of Dover, by the way, this region of low variability (and of high salinity) is only characteristic of the centre of the Channel; and again between Shetland and Norway the region of low variability, like that of high salinity with which it corresponds, is thrust far out from the Norwegian coast by the large and fluctuating supplies of fresh water which that coast sends down to the sea.

The salinity over the greater part of the North Sea is subject to a periodic annual fluctuation of from $\cdot 1^\circ/_{\circ\circ}$ to $\cdot 5^\circ/_{\circ\circ}$ of salinity (or ·1 to ·5 grams of chlorides per 1,000 grams of water). But this fluctuation increases rapidly towards the eastern parts of the sea as we approach the Norwegian and Danish coasts, and especially as we enter the Skager Rack. At the entrance to the Cattegat we have an annual fluctuation of about $10^\circ/_{\circ\circ}$ (on a mean salinity of somewhere about $25^\circ/_{\circ\circ}$), and sweeping round the northern part of the Skager Rack as far as the Naze we still have a region characterized by an annual fluctuation of over $5^\circ/_{\circ\circ}$. Along the southern side of the Skager Rack the fluctuation is much less, and falls rapidly as we approach the North Sea.

Over the Dogger Bank the range of fluctuation is certainly very small, but the quarterly observations which we have for this region are by no means sufficient for the investigation of so small a periodic change, and our stations are also few. I have provisionally drawn the curve which represents the limit of $\cdot 2^\circ/_{\circ\circ}$ of mean variation so as to run continuously southwards down to the Dogger Bank from an area which we are well able to define from our Scottish work ; but I rather think there are signs of a region over the bank itself where the fluctuation is at a minimum, and where it is surrounded on all sides by regions of somewhat greater fluctuation ; in other words, I suspect that the curve of ·2°/$_{oo}$ variation ought to be a discontinuous one. As regards the configuration of the chart itself, the matter is not a very important one, for the differences involved are so slight that, if one contour-line were interrupted, another of very slightly different value would be continuous. But it is by no means improbable in itself that we should find somewhere in the region of the Dogger Bank an area characterized by very small variation. Not only is this area known to be one of small or vanishing tides, so that one cause of intermixture is here greatly lessened, but also, it will share in the steadying influences of the double supply of oceanic water from the north and from the channel ; and furthermore, it will tend to be shielded from the influence of the fresh waters of the German coast by that prolongation or tongue of salt water that, at least at certain seasons, is traceable a long way eastward from its entry into the North Sea at the Straits of Dover.

As regards the mean variation at the bottom, the greater part of the bottom of the North Sea is found to be subject to an annual fluctuation of between ·1 and ·2°/$_{oo}$. The chief difference from the former chart, as regards the direction of the contours, is found in the fact that a region of very low variation (instead of a comparatively high one) lies adjacent to the Norwegian coast and extends to the Skager Rack ; this corresponds to the position of the " Norway Deep," that great trench or furrow that lies parallel to the coast, in direct communication with the deep oceanic waters of the Norwegian sea.

8. The foregoing facts may be somewhat further elucidated by the help of " isopleth " diagrams, in which (as in our previous report upon sea temperatures) a period of time is represented by ordinates, distance from one point to another of the sea by abscissae, while the salinities are expressed by contour lines or " isopleths."

In the first of these diagrams (Fig. 9) we represent the surface phenomena as regards salinity on a line from the Firth of Fourth to the coast of Norway in the neighbourhood

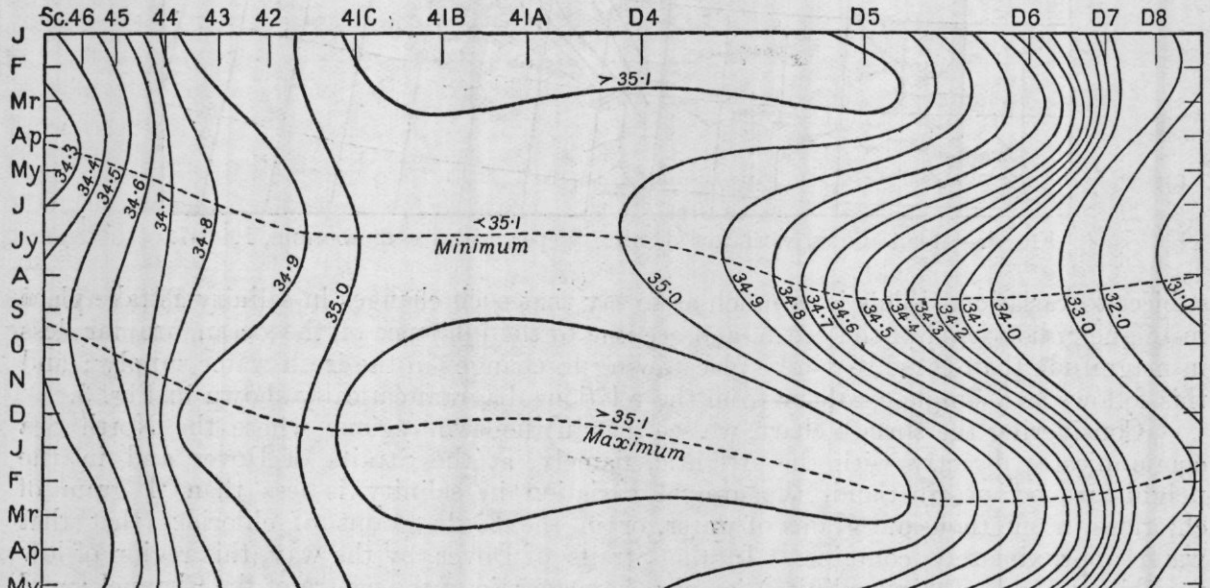

FIG. 9.—Diagram showing mean variations of surface salinity along a line from the Firth of Forth to the Naze of Norway.

of Lindesnaes. We see that towards the middle of the North Sea we cross a region of maximal salinity as well as of minimal variability, the salinity at our Scottish stations 41B and 41A only varying a little on either side of 35·1°/$_{oo}$. As we pass westward towards the Firth of Forth, new isohalines succeed one another, but they are comparatively little bent, and though the salinity falls, the annual range does not very greatly increase. On the other hand, as we pass eastward, not only do the isohalines become extremely numerous, but they form very sinuous curves, so that a vertical line cuts them in increasing numbers ; in other words, at any given point the variability in time becomes extremely great. Thus at Station D. 7, in the neighbourhood of the Norwegian coast, the range is from about $32°/_{oo}$ to over $34°/_{oo}$. We can further trace upon this diagram the dates of maximal and minimal salinity, though it must always be remembered that the number of our observations and the process of interpolation by which the curves have been constructed do not permit us to accept, without the greatest caution, any but the most salient features of the diagram. We see that in the central part of the sea the minimal salinity is in summer, and the maximum in winter. The corresponding dates are undoubtedly earlier as we approach the Scottish coast, and they again advance in the neighbourhood of the coast of Norway, probably to a greater extent than our diagram actually shows.

The next diagram (Fig. 10) covers a series of stations from Sc. 4 at Fair Isle to D. 14 near the Horn Reef, on the Jutland coast. The phase is nearly identical at all parts of the diagram, showing a maximum everywhere in spring, and a minimum everywhere in

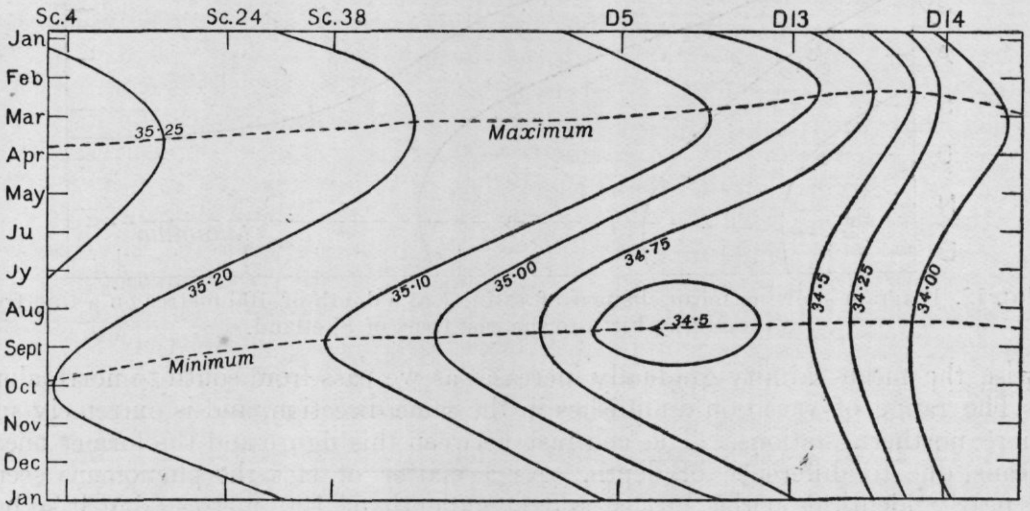

FIG. 10. Diagram showing mean changes of surface salinity along a line from Fair Isle to the Horn Reef.

autumn. The mean salinity diminishes steadily from the Shetland to the Danish end of the line. The range of variation tends to increase in the same direction, but seems to be greatest between Stations D. 5 and D. 13, which lie most nearly opposite to the mouth of the Skager Rack.

The next figure (Fig. 11) is compiled from such observations as we have from the work of the Dutch Commission (though in this part of the sea they are at best scanty),

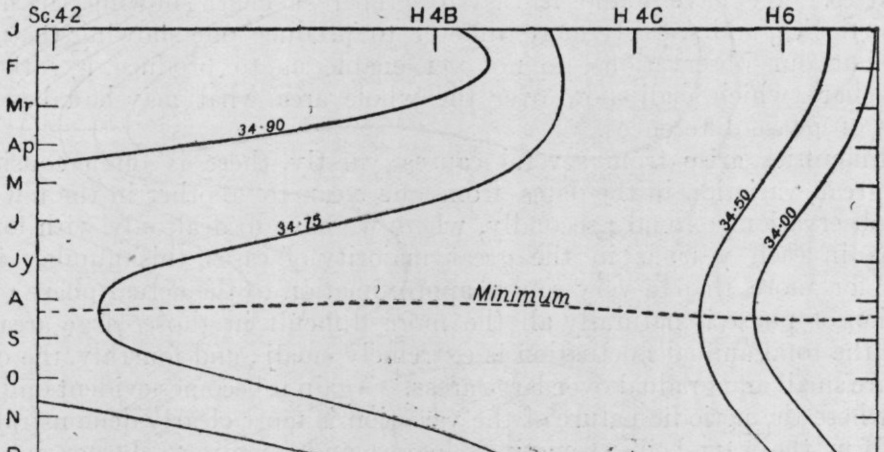

FIG. 11. Diagram showing mean changes of surface salinity off the east coast of Britain, from the latitude of the Firth of Forth to that of the Humber.

parallel to the English coast from off the Firth of Forth to the neighbourhood of the Humber. The phenomena agree in a general way with those indicated in the preceding figure.

Lastly, Fig. 12 is drawn for a depth of 100 metres on the line of stations from the mouth of the Moray Firth to the east coast of Shetland. The phases are very nearly the reverse of those seen in the preceding figures, for the maximum salinity is evidently in summer-time, and the minimum is near to midwinter. The highest salinities shown are in the neighbourhood of Stations Sc. 4 and 5, that is to say in the Fair Isle Channel, but

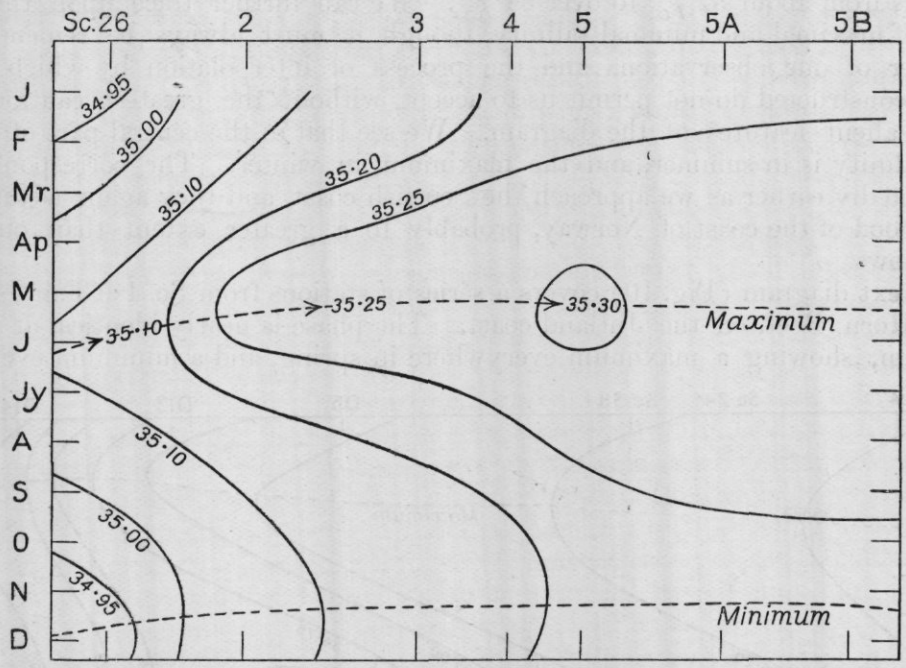

FIG. 12. Diagram showing mean changes of salinity at a depth of 100 metres on a line from the Moray Firth to the east coast of Shetland.

otherwise the mean salinity gradually increases as we pass from south to north along the line. The range of variation diminishes in the same direction, and is extremely small at the more northern stations. The contrast between this figure and the former ones is by no means due to difference of depth. As a matter of fact the phenomena seem here to be nearly identical at the surface and at a depth of 100 metres; but it so happens that the curves at this latter depth come out somewhat more simply and smoothly, being less disturbed by minor perturbations.

THE EPOCHS OF MAXIMAL AND MINIMAL SALINITY.

9. Though we have introduced the subject of phase, that is to say the question of mean date of minimum and maximum salinity at the various points, in the immediately preceding description of our isopleth diagrams, yet the more comprehensive study of phase in regard to variation of salinity over the North Sea as a whole proves to be a very difficult matter. We have found it easy to prepare a chart showing the mean salinity over the North Sea, and scarcely more difficult to produce one showing the mean annual variation; but our observations do not yet enable us to produce a satisfactory and convincing chart, which shall show over the whole area what may be taken as a normal distribution of phase differences.

Our difficulties arise from several causes; firstly, there is often considerable, and sometimes great, variation in the dates from one year to another in the few years over which our observations extend; secondly, where we have to deal only with four quarterly observations in each year, as in the great majority of cases, this number is evidently insufficient for more than a very rough approximation to the actual phase; thirdly, the determination of phase is naturally all the more difficult in those large areas of the sea over which the total annual fluctuation is extremely small; and fourthly, the differences of phase also are small and gradual over large areas. Again it becomes evident on investigation that, even where the periodic nature of the variation is most clearly demonstrable, it varies greatly in form, the wave being sometimes longer, and sometimes shorter, in other words, the maximum and minimum coming sometimes near together, and sometimes dividing the year into approximately equal intervals. Once again, there are certain regions of the sea, as within the limits of the Skager Rack, and again off the east coast of Scotland, where the phase appears to alter very suddenly within short distances, and our observations are neither near enough in point of distance, nor frequent enough in point of time, to enable us to trace the boundaries and other conditions of these diverse phenomena.

Lastly, over and above all these more or less obvious sources of difficulty, there lies the essential fact that the surface salinity varies in response to several distinct causes, and that the phenomena of phase are for this reason essentially complex. Firstly, it is now well-known that surface temperature is an important factor in the case, for the fresher waters that, if present, float freely on the surface in summer-time, may in winter-time be so far cooled below the temperature of the under-lying salter layers as to equal, or even exceed, them in density, and will then tend to sink and mix readily with them ; there will, accordingly, be a tendency to a seasonal change, due directly to temperature, giving rise to lower surface salinities in summer than in winter-time. We have, in the next place, the varying meteorological phenomena of rain-fall, and of the freezing-up of the streams and rivers in winter and their more or less sudden liberation in spring; and these phenomena will act in different ways and with very different intensities in different regions ; their general tendency will be to increase the outflow of fresh waters into the sea in winter-time in regions where no long-continued frost occurs, and in early spring in regions where severe winter cold binds the rivers until they are released by thaw. Winds and currents no doubt complicate the matter, in ways and in directions that we as yet very imperfectly understand. The direct phenomena of evaporation will also play a part in the case, and will have a tendency to increase the surface salinity in summer-time as compared with winter ; and this factor will tend to run counter to that more indirect consequence of temperature-change which we first described. Lastly, there remains the fluctuating supply of oceanic water penetrating into the North Sea, due to fluctuations in the great Atlantic currents, which fluctuations we now know to be more or less regularly annually periodic, but to be at the same time subject to variations of longer or less regular period. It has been shown that the so-called Gulf Stream current, which flows on its north-easterly course through the Faroe Channel off the north-west of Scotland, is reinforced, as it were, by an annual pulse in summer-time, and weakens in winter. We shall expect to find from this cause an increase of salinity in summer-time, at least in those portions of the North Sea that by proximity to the ocean are most exposed to its direct influence. It would be of the highest interest for the solution of all the difficulties that these complicated factors confront us with if we could form an approximate estimate of the actual quantity of salt present at various epochs within the basin of the whole North Sea, and could discover whether that whole amount be a variable one, and whether it be subject to periodic variation. I have made laborious attempts to attack this problem, but I believe that it is not yet ripe for even approximate solution ; there are too many areas of the North Sea for which we have practically no information at all, and too many others in which our observations are inadequate for such a process of integration.

10. It follows that while at first sight it might seem no very difficult matter to trace by contour lines upon the chart the mean epochs of maximum and minimum salinity from month to month, yet in the present state of our knowledge the task proves to be beyond our powers.

We can, however, lay down certain statements with considerable confidence, finding confirmation of them in various ways ; but we must restrict ourselves to stations where the periods in the several years of investigation are not greatly divergent. In order to do this we have tabulated from the interpolated curves for each station the apparent dates of maximum and minimum salinity in each year, and have tried to strike a balance for each station between the results shown, discarding at the same time those stations where the results were discordant and irregular. The general result has been to show that we have too little ground on which to base the determination of an annual period (1) in nearly the whole of that northern area where the mean salinity exceeds $35{\cdot}20°/_{00}$, in other words, in the salt water to the east of Shetland and southwards to the neighbourhood of our station Sc. 38 in lat. 58° 34′ N., long. 0° 47′ E. This corresponds on the whole to the region where the mean annual variation is less than $\cdot 1°/_{00}$. Again we find difficulty along the Danish coast, where, on the one hand, observations out to sea are few, and where, on the other hand, observations at the lightships are greatly complicated by tidal phenomena ; we have similar difficulties off the east coast of England, and lastly, in the region of the Dogger Bank and generally over the middle of the North Sea, where the variation is again comparatively small, the determination of phase is very uncertain.

11. At the whole of our stations in the northern Cattegat and in the Skager Rack a period of maximum salinity at the surface is indicated in winter-time, somewhere about the month of January and February ; and over the whole of the same region, with the exception of a strip entering the North Sea off the north coast of Denmark, we find very clear indication of an epoch of minimal salinity about the month of May. Within the strip already alluded to off the Danish coast (which includes Stations S. 5 and S. 6, D. 11 and D. 12, the period of minimal salinity occurs about August, or later ; while at the

Swedish stations nearer to the Norwegian coasts of the Skager Rack, there would appear to be (so far as the quarterly observations permit us to judge) a tendency to a subordinate maximum of salinity in summer-time, about the month of August.

In the German Bight, in the region influenced by the Elbe and the Weser, and also off the mouth of the Rhine, there is again a winter maximum of salinity, but apparently a little earlier than in the Skager Rack, viz., in December–January, rather than in January–February. Again in the German Bight the minimum salinity appears to occur about May, but off the Dutch coast it would seem to be somewhat later, about July.

On the line of Scotch stations, running in an easterly direction from the Firth of Forth, there is a distinct evidence of periodic variation, the maximum salinity appearing in all cases about December or January, and the minimum about June or July. Within the Firth of Forth itself, and in its immediate neighbourhood, both dates appear to be a month or two earlier.

The few stations that we have to the northward of the North Sea, and in the neighbourhood of the Norwegian coast (Sc. 7, 8 and 9) appear to indicate a maximum in winter and a minimum in summer, but the observations are scanty. The same is true of the German Stations D. 6, 7 and 8 off the south-west coast of Norway, where the maximum appears about February to April, and the minimum from June to August, both dates on the whole corresponding, but with a certain retardation, to the phenomena found within the Skager Rack.

Over all the rest of the North Sea the various dates of maximum lie on the whole in spring, from about February or March to May, and the dates of minimum in summer or autumn, from about August to October; and these periods, as far as I can judge, would appear to be most retarded over the region of the Dogger Bank.

The line of stations running from the Moray Firth to the east side of Shetland are characterised by a very different period, for in them, without exception, we find evidence of a period of minimum salinity about November–December, and of a period of maximum in spring or early summer, usually about the month of April, and extending to June.

In the region of the Atlantic inflow at the Straits of Dover, and immediately to the eastward thereof, there appear to be somewhat phenomena; and, unless I am greatly mistaken, there is a large and gradual retardation of phase from north to south, along the line of Belgium stations, from the Essex coast to Ostend. I do not propose to discuss further the conditions existing in this region.

The above preliminary and approximate results may be epitomised in the following table:—

APPROXIMATE DATES OF MAXIMAL AND MINIMAL SALINITY IN THE SURFACE WATERS.

	Maximum.	Minimum.
German Bight	December, January	May.
Eastward of Firth of Forth	" "	June, July.
Skager Rack	January, February	May.
" (north coast of Denmark)	" "	August.
East coast of England	February	August.
South-west coast of Norway ...	February, April	June, August.
Dutch coast	" "	July.
Rest of North Sea	February, May	August, October.
Moray Firth to Shetland	April, June	November, December.

12. While I have hesitated, for want of sufficient evidence, to put upon a chart what appear to be the annual epochs of maximal and minimal salinity I give two charts showing, as far as evidence permits, the mean surface salinities over the North Sea for the months of February (Fig. 13) and August (Fig. 14).

It will be observed (1) that somewhat greater salinities are represented in the neighbourhood of the Channel, and somewhat less to the north of Shetland, in the February chart than in that for August; but, on the other hand, the extension of moderately salt water, down to $34{\cdot}75^{\circ}/_{\circ\circ}$, is very much greater in February than in August, both from the direction of the Channel and from the North. In the Skager Rack the salinities are much greater in February; the isohaline of $31{\cdot}0^{\circ}/_{\circ\circ}$ lies well within the Skager Rack in February; but passes outwards in the direction of Stavanger in August, though in both cases its lower or southern end is in the neighbourhood of the Skaw. The $34{\cdot}0^{\circ}/_{\circ\circ}$ isohalines sends in February a long tongue eastward into the Skager Rack, but in August not only it, but also the $33^{\circ}/_{\circ\circ}$ and $32^{\circ}/_{\circ\circ}$ isohalines, lie more or less out in the North Sea, and do not enter the Skager Rack at all.

All the isohalines from 34·75°/$_{\circ\circ}$ upwards, which come looping down into the North Sea from the Shetland region, are more or less shrunken in August as compared with

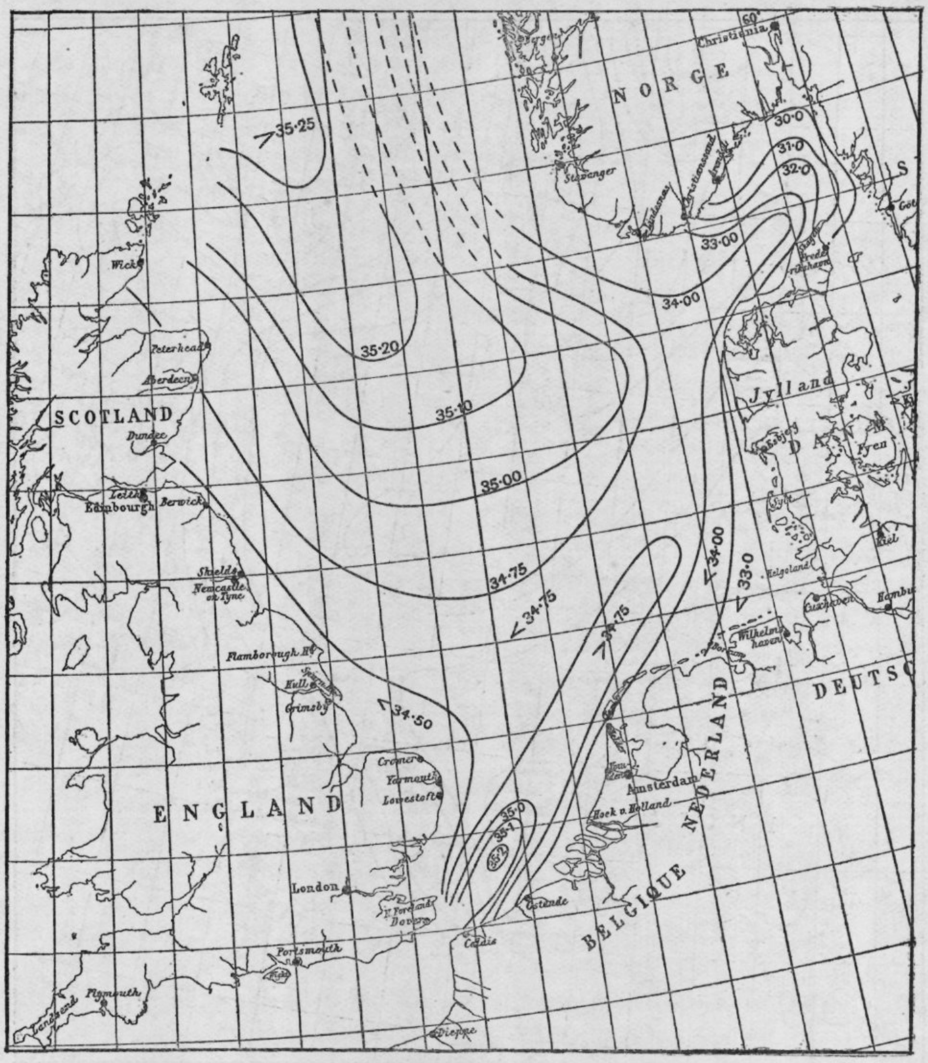

FIG. 13.—Mean surface salinity of the North Sea for the month of February, 1903–7.

February, and while their elongation in a north and south direction is somewhat diminished, it is a still more conspicuous feature that their eastern extensions are pushed towards the west. This is the result, and the representation, of that great extension of comparatively fresh waters in summer-time over the North Sea from the direction of the Skager Rack and the Norwegian coast, which we have now learnt to look for as a regular periodic occurrence.

13. The fluctuations in regard to salinity over any particular area or line of stations may, after all, be most safely studied by inspection of the sections drawn for each cruise, for in these the risk of error arising from interpolation is at a minimum; but the method is laborious, owing to the number of such sections, and the multiplicity of detail that is represented in each. We may, however, draw simplified sections, inserting in them only the main features, and doing so within the limits of a single diagram, for several successive dates. Fig. 15 represents a section from station Sc. 26 to Sc. 5A, that is to say, from the mouth of the Moray Firth to the east side of Shetland. On the whole the salinity tends to increase pretty regularly from the former to the latter end of the section. We have represented on this diagram two isohalines only, namely those for 35°/$_{\circ\circ}$ and 35·25°/$_{\circ\circ}$, and we have repeated these isohalines for each of the four cruises made in 1907. To the southward of the 35°/$_{\circ\circ}$ line the salinity is all below 35°/$_{\circ\circ}$, to the northward of the 35·25°/$_{\circ\circ}$ isohaline it is all above 35·25°/$_{\circ\circ}$. It will at once be seen, as regards the 35°/$_{\circ\circ}$ isohaline that this is shifted in August close to the southern end of the diagram, and that then it embraces only the upper layers of water; in other words, nearly the whole of the diagram is filled by water over 35°/$_{\circ\circ}$ salinity. In February, on the other hand, a considerable space, from top to bottom, is filled with water below 35°/$_{\circ\circ}$, and the same is the case, though over a somewhat less area, in the month of November. As for the 35·25°/$_{\circ\circ}$ isohaline, no such line appears in the diagram for the month of November, while of the other months represented, this isohaline has its most northerly position in

February. In May and August the main 35·25°/$_{oo}$ isohalines appear between stations Sc. 3 and Sc. 5, the former being to the southward of the latter ; but in August there is

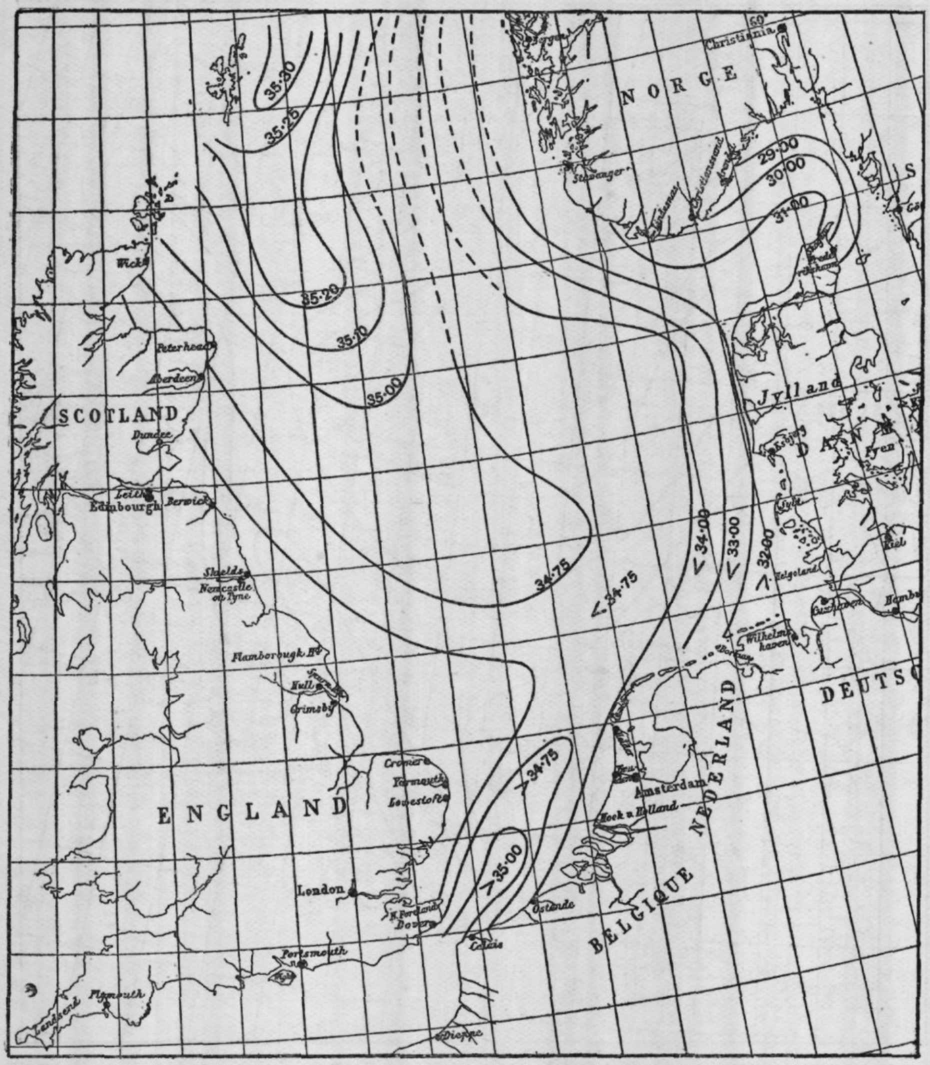

FIG. 14.—Mean surface salinity of the North Sea for the month of August, 1903–7.

another 35·25°/$_{oo}$ isohaline, marking off a layer of salt water at the bottom in the southern part of our section. The two series of isohalines, accordingly, do not run parallel or equidistant, to one another ; but it is clear on the whole that, of the months represented, it is November in which the salinity along this line of stations is least, and August

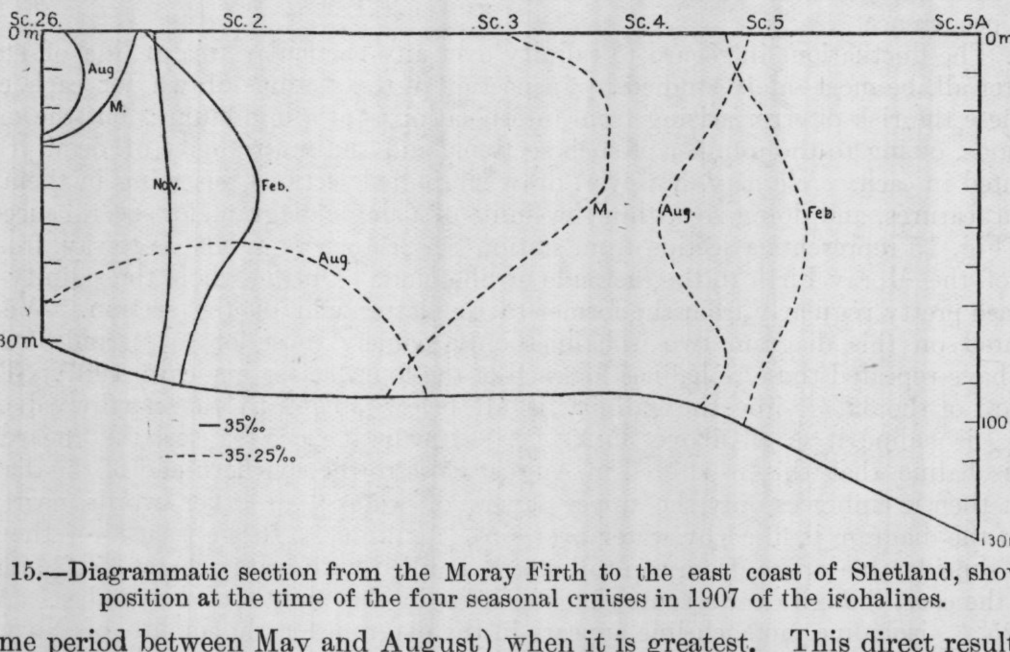

FIG. 15.—Diagrammatic section from the Moray Firth to the east coast of Shetland, showing the position at the time of the four seasonal cruises in 1907 of the isohalines.

(or some period between May and August) when it is greatest. This direct result of our seasonal cruises during 1907 is so far in conformity with the mean result that we have obtained in other ways, namely, that the period of maximum salinity for this region is in summer, probably about June or July, and the period of minimal salinity in winter, about November or December.

The next diagram (Fig. 16) illustrates our line of section running eastward from the Firth of Forth, the least saline water being at the western end of the line within the Firth itself, and the general tendency being for it to grow salter as we proceed seaward.

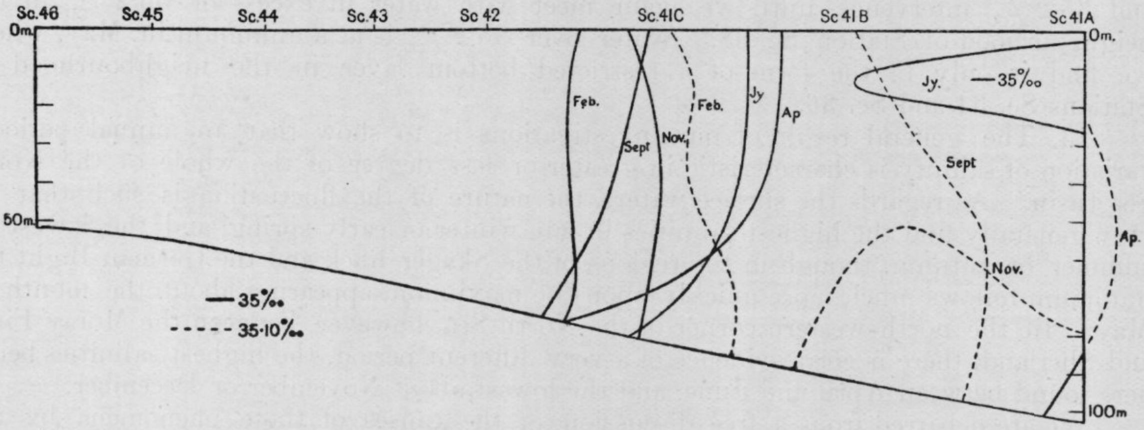

FIG. 16.—Diagrammatic section from the Firth of Forth eastward, showing the position of the isohalines corresponding to salinities of 35·00 and 35·10 per mille at various seasons during the year.

In this case the isohalines presented are those for 35°/$_{oo}$ and 35·10°/$_{oo}$. It will be seen that (of the month represented) February is distinctly that one which shows the highest salinities ; for, not only is the 35°/$_{oo}$ isohaline furthest to the westward in this month, but so also, and in greater degree, is the isohaline of 35·1°/$_{oo}$; the space included between these two isohalines is only a narrow strip, and water, whose salinity exceeds 35·1°/$_{oo}$, occupies nearly the eastern half of the whole section at all depths. On the other hand, in the month of July no water with a salinity so great as 35·1°/$_{oo}$ appears in any part of the diagram, but a tongue of fresh water, even below 35°/$_{oo}$ salinity, is seen entering the section from the east and near to the surface. By September we find a considerable invasion of water over 35·1°/$_{oo}$ at the eastern end of the section, but in November (at least in this particular year) such water had not increased in quantity, but has rather diminished, being found only in the deeper layers. On the whole it is clear that the period of maximal salinity is here a winter one, and that of minimal salinity a summer one. Figure 17 is a somewhat more complicated diagram for the line of stations from

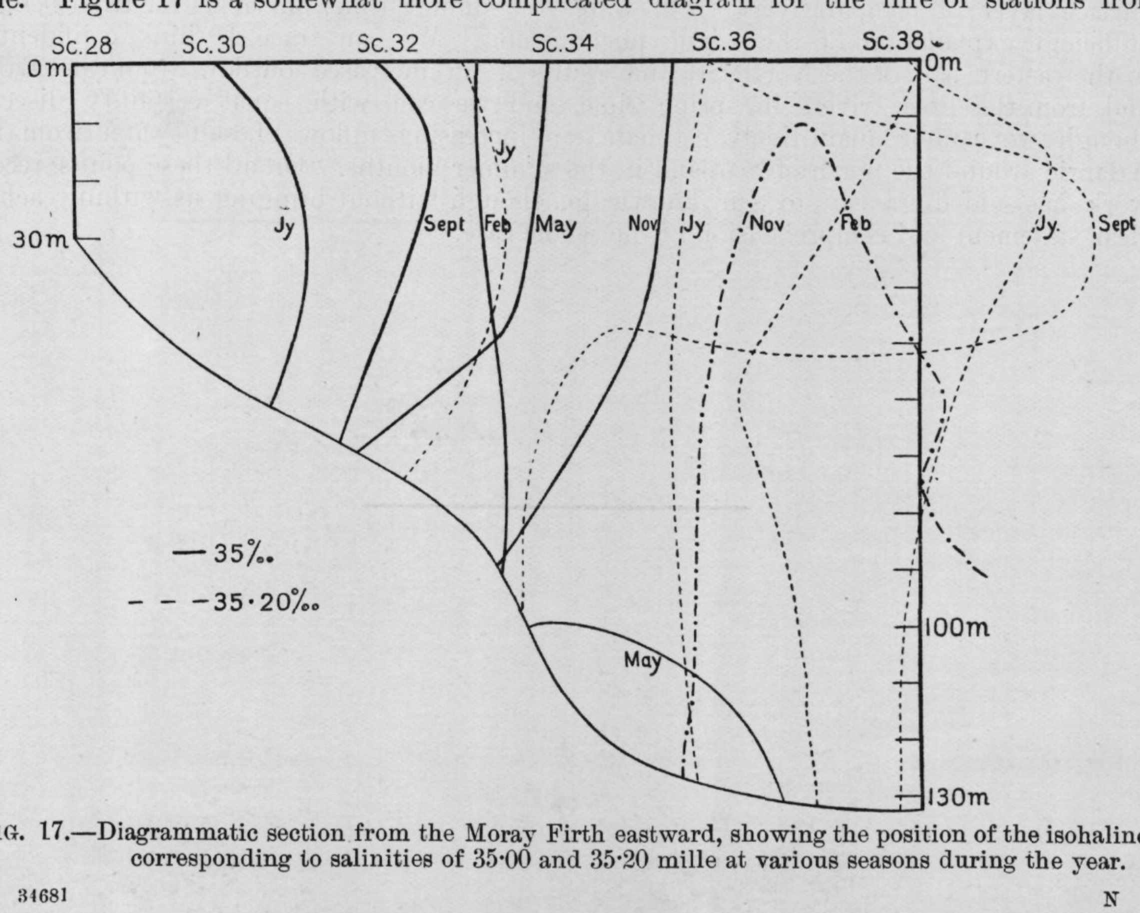

FIG. 17.—Diagrammatic section from the Moray Firth eastward, showing the position of the isohaline corresponding to salinities of 35·00 and 35·20 mille at various seasons during the year.

the Moray Firth eastward. As regards the 35°/$_{oo}$ isohaline, it is clearly furthest to the westward in July, and most distant from the shore in November ; the former season is that in which comparatively fresh water below that density is at a minimum. But the distribution of water over 35·20°/$_{oo}$ is rather more complicated. It is in July that such water comes furthest westward, or shoreward, but it is in the form of a comparatively narrow band in the neighbourhood of Station Sc. 4, after which a region between 35°/$_{oo}$ and 35·2°/$_{oo}$ intervenes, until we again meet with water in excess of 35·2°/$_{oo}$ in the neighbourhood of Station Sc. 38. Water over 35·2°/$_{oo}$ is at a minimum in May, where we find it only in the form of a restricted bottom layer in the neighbourhood of Stations Sc. 34 and Sc. 36.

14. The general result of our investigations is to show that an annual periodic variation of salinity is characteristic in greater or less degree of the whole of the North Sea basin. As regards the surface waters, the nature of the fluctuation is such that we very generally find the highest salinities in late winter or early spring, and the lowest in summer or autumn, though in the regions of the Skager Rack and the German Bight the minimum follows much more quickly upon the maximum, appearing about the month of May. In the north-western corner of the North Sea, however, between the Moray Firth and Shetland, there is clear evidence of a very different period, the highest salinities being here found between April and June, and the lowest about November or December.

We are debarred from a free discussion of the causes of these phenomena by the insufficient details of our knowledge regarding the periodic phenomena at the surfaces and still more by the fact that we have made no adequate investigation, even of the available facts, in regard to the periodic variation in the deeper waters. The last diagrams (Figs. 15 to 17) in this paper are sufficient to remind us that the phenomena of periodic variation are far from being limited to the surface, and the same fact can be readily seen from the work already done by other investigators, for example, in the region of the Skager Rack. I venture to say, though I have not yet furnished the necessary proof, that so far as I have worked at the conditions of the deeper waters, I believe that the mean salinity at all depths will be found to follow much the same rule as the salinity at the surface, namely, to show a general increase in winter, and a general decrease in summer time.

While the frequent approximate coincidence of maximal and minimal surface salinities with the epochs of maximal and minimal temperature of the surface waters would lead us to attribute the seasonal difference in surface salinity to the varying temperature conditions, I feel convinced that such an explanation is only partially valid. It no doubt facilitates the extension westward from the neighbourhood of the Skager Rack of a surface layer of comparatively fresh water in summer-time, but it is far from being a sufficient explanation of the whole phenomenon. We can trace, I think, confidently, in the eastern part of the North Sea the results of an increased outflow from the Baltic and from the great rivers in spring time, and we can with equal certainty discern, though we cannot quantitively estimate, an increasing inflow of salt water from the Atlantic around the north of Scotland in the summer months. On all these points recent work has added greatly to our knowledge, though without bringing us within reach of clear statement and comprehension of the whole case.

SURFACE TEMPERATURE OBSERVATIONS BETWEEN HULL AND HAMBURG, 1877-1883,

BY

D'ARCY WENTWORTH THOMPSON.

CONTENTS.

SURFACE TEMPERATURE OBSERVATIONS BETWEEN HULL AND HAMBURG, 1877–1883,

BY

D'ARCY WENTWORTH THOMPSON.

By the kindness of Dr. W. N. Shaw, F.R.S., and Captain Campbell-Hepworth, C.B., the Director and Marine Superintendent of the Meteorological Office, we have had an opportunity of examining a valuable series of log-books kept by Captain W. Barron, of the Steamships *Sultan* and *Empress*, on the route from Hull to Hamburg between the dates of October, 1876, and October, 1883.

Besides valuable meteorological observations of various kinds as to wind and weather, height of barometer, air-temperature by wet and dry bulb, etc., these log-books also contain regular observations of the surface temperature of the sea ; and they give us this information for a longer consecutive period than any other observations to which we have had access, save from certain Lightships and other stations at or near the shore.

The sea-temperatures are given in degrees Fahrenheit, read to degrees and half degrees, and as a rule from 8 to 10 observations are recorded, at intervals of four hours, for each passage between the two ports. The passage was made once a week with few interruptions. The position of the ship is not recorded in latitude and longitude, but merely by course and distance in each four hours' watch, and it is therefore only possible or feasible to ascertain the points at which the temperature observations were made by a rough and approximate method. What we have done is as follows. Taking for each voyage the entire distance sailed between the Newsand and the Elbe Outer Lightship, we lay off a corresponding distance upon squared paper, and plot the observed temperatures at points along the line corresponding to the distance made in each watch, that is to say between each pair of observations. The temperature readings are then connected up by a freehand curve. Next, upon the line or ordinate which represents the entire course, the points are found which correspond to the degrees of longitude crossed, namely 1° East to 8° East, and the temperature corresponding to the points where the course crosses the several meridians are read from the interpolated curve. The points at which the course crosses the meridians are, approximately, 1° E., 53° 37′ N. ; 2° E., 53° 42′ N. ; 3° E., 53° 46′ N. ; 4° E., 53° 50′ N. ; 5° E., 53° 54′ N. ; 6° E., 53° 58′ N. ; 7° E., 54° 3′ N. ; 8° E., 54° 7′ N. It is not necessary to point out that this method is a rough one, nor that it is especially liable to error on stormy and lengthened passages. But the errors, inseparable from the method, do not seem to be cumulative, but to be such as cancel one another in the number of observations : and the curve of readings for each voyage comes out, as a general rule, in a clear, even and harmonious manner, indicating steady differences of phenomena along the line of observation. The readings for each month are averaged for each of the eight points where the meridian-lines are crossed, and the average readings are converted from Fahrenheit into Centigrade degrees (Table I). We have next resolved each annual series of monthly averages at each station into a simple harmonic formula, and further the monthly means and the harmonic constants have been averaged for the whole period of seven years. Finally, we have taken for each year the average of the monthly means at *all* the eight points of longitude, and have so obtained a single average estimate of the temperature conditions over this region of the sea for each of the seven years under observation (Table II). In discussing the results, we shall find it convenient to deal with the subject in two parts : firstly the *mean* phenomena, or the average of the results obtained during the seven years for which observations were made, and secondly the particular features presented by each of the seven years.

I. The Mean Phenomena of the Seven Years 1877–1883.

Dealing in the first instance with the monthly averages at the eight stations for the entire series of seven years, and applying to these our elementary harmonic analysis in the manner described in a former volume of our Reports, we obtain, according to the formula $f\ (t) = A_0 + A_1\ \sin(\theta + e_1) + A_2\ \sin(2\theta + e_2)$ etc., average values for (1) the mean temperature, A_0 ; (2) the range, or rather the half range, of temperatures, A_1 ; (3) the *phase* of our sine curve, e_1. From the last of these we may obtain an approximate value for the date of maximum or of minimum, and from the former two we may obtain approximate values for the mean maximum or minimum temperatures of the year, in so far as the fundamental curve is concerned (Tables III, IV).

So far we deal only with the first harmonic, or annual wave, which has its obvious physical interpretation in the course of the seasons, that is to say, in the varying declination of the sun. How far, and in what direction, the actual mean temperatures, as found from the observations, differ from this fundamental sine curve is a matter to be dealt with afterwards.

We now learn, from a study of the results given, that—

(1) The *mean surface temperature* of the sea rises steadily on the line from Hull to the Elbe (Fig. 1), reaching a maximum value rather to the westward of the longitude of

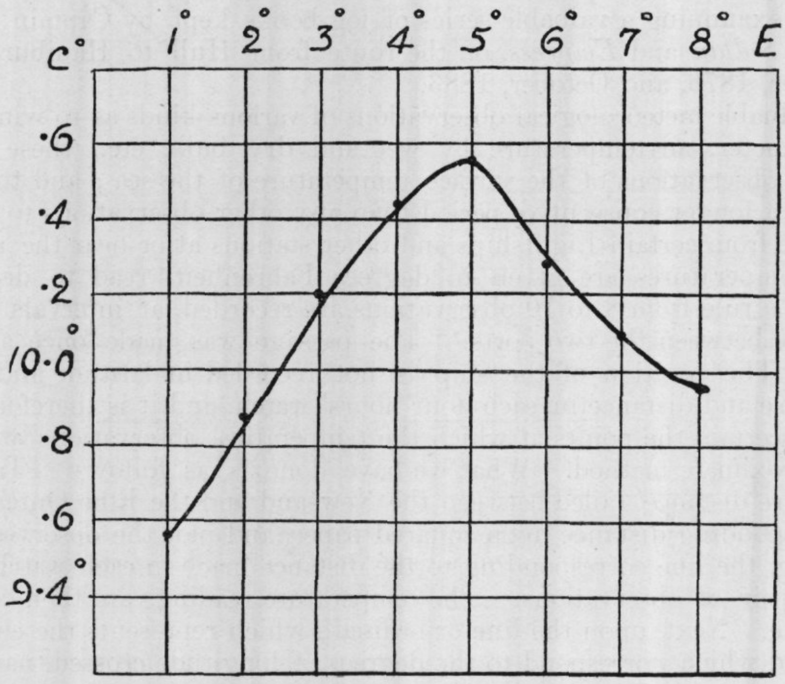

FIG. 1. Mean surface temperature of the sea (1877–1883) along a route from the Humber to the Elbe.

5° East, that is to say due north of the Zuyder Zee or where the Dutch coast bends off to the eastward. From that point towards the mouth of the Elbe, the mean temperature diminishes. At the point named, the mean temperature is nearly 1° Centigrade higher than at our nearest station to the English coast, a little to the north of the Outer Dowsing, and about ·4° C. higher than in 8° East longitude in the neighbourhood of Helgoland (*see* Tables II and III).

This agrees with the results that we have arrived at in recent years, where in our series of temperature observations across the North Sea we have invariably found a higher mean temperature at some intermediate point, and a lower as we pass towards the opposite coasts. In this case, however, it will be seen that the point of highest mean temperature by no means corresponds to the greatest distance from land, nor is it very much further from the continental coast than the more easterly stations along the route, which show a steadily diminishing mean temperature.

If we refer to our observations on the route from Harwich to Hamburg for 1906, we shall see that along that route the point of highest mean temperature is again in the neighbourhood of 5° East, though in 1905 it was apparently somewhat further to the West, in 3° East. Our Leith to Hamburg observations for 1904–1906 show us the highest mean temperature in longitude 6° East. We lack, unfortunately, any series of observations running directly from one of our East Coast ports to the coast of Holland, but nevertheless we have no difficulty in discerning that there is a line of comparatively high temperatures running from the Channel in a north-easterly direction, apparently following in the first place the line of the Dutch coast, but at some distance from it, and afterwards prolonged in a similar direction into the eastern part of the North Sea.

(2) Unlike the mean temperatures, which reach their highest value, as has just been said, at about 5° E., the mean *annual range* of temperature rises greatly, and on the whole steadily, from the Humber to the Elbe (A_1, Table III). The entire range at our first station in 1° E. is about 9·5° C., while in the neighbourhood of Helgoland it is

about 14·7°. The rise is at first somewhat slower, but grows more rapid as we proceed eastward ; it tends to slacken to a slight degree between 5° and 6° E. longitude, but from Borkum to the Elbe the rise is particularly rapid. This phenomenon of an increasing range of temperature as we pass from the insular to the continental coasts is now well-known (Fig. 2*).

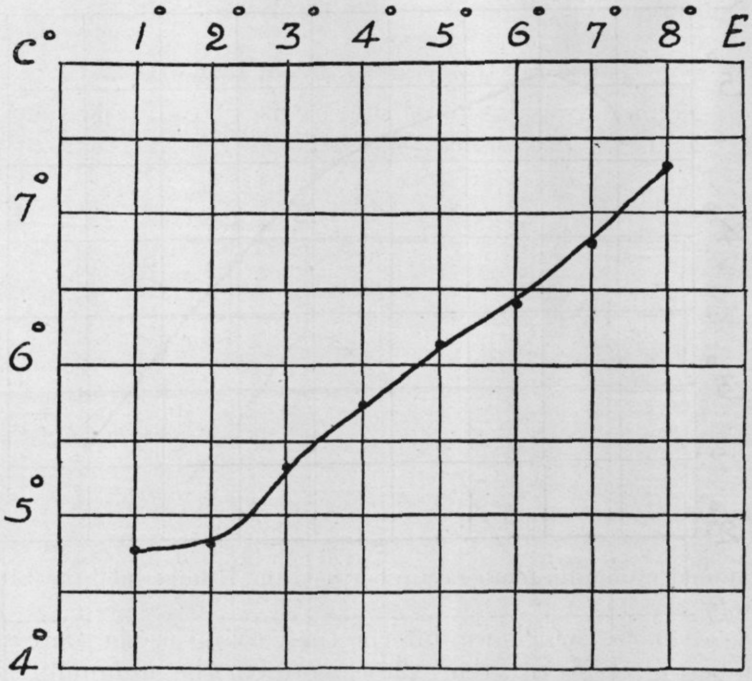

FIG. 2.—Mean half-range of surface temperature (or difference between mean annual temperature and mean maximum or minimum) along a route from the Humber to the Elbe (1877–1883).

(3) The *mean maximum temperature*, as deduced from the mean temperature and the half range, rises gradually as we proceed eastward, but the rise is slow to the eastward of 5° E. (Fig. 3).

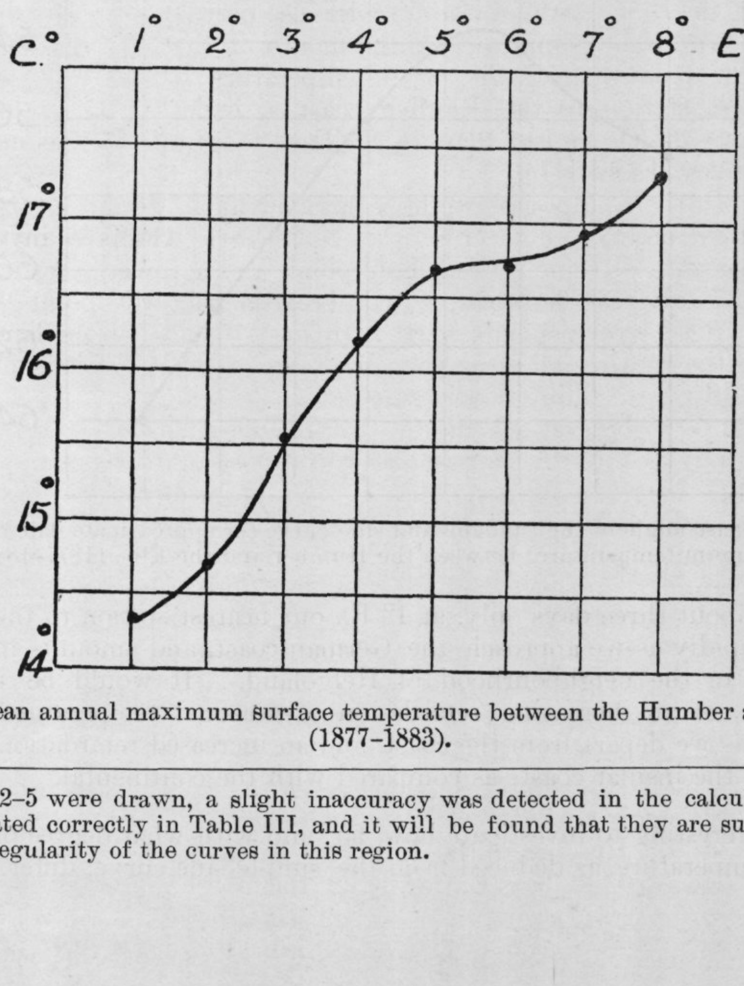

FIG. 3.—Mean annual maximum surface temperature between the Humber and the Elbe (1877–1883).

* After Figs. 2–5 were drawn, a slight inaccuracy was detected in the calculations for 2° E. lat. The figures are stated correctly in Table III, and it will be found that they are such as to remove an apparent slight irregularity of the curves in this region.

(4.) The *mean minimum temperature*, on the other hand, varies little at the stations nearest to the English coast, but falls steadily from 3° E. to the mouth of the Elbe. From 1° E. to 4° E. the mean minimum lies approximately between 4·8° and 5·0° C., but falls to 2·6°, or thereby, in the neighbourhood of Helgoland (Fig. 4).

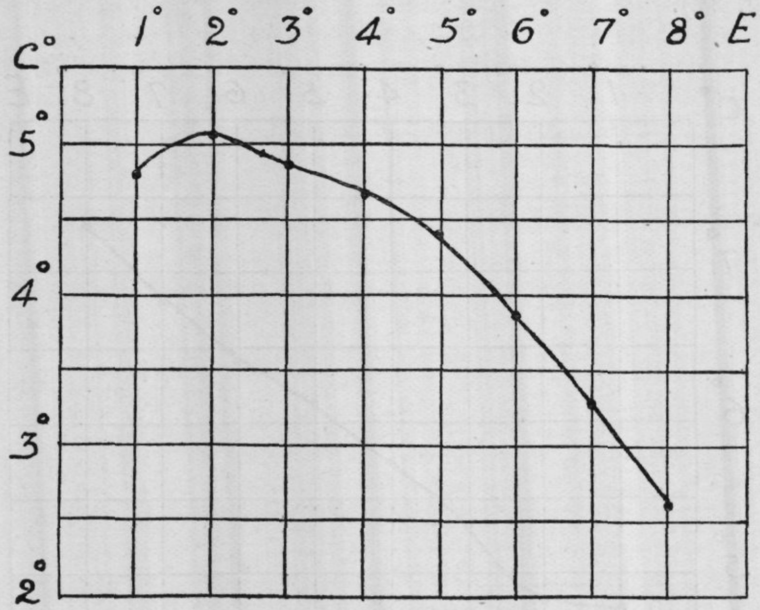

FIG. 4.—Mean annual minimum temperature between the Humber and the Elbe (1877–1883).

(5.) The *phase angle*, which we interpret as giving us the date of minimum and maximum (remembering, however, that these represent the minimum and maximum of the simple sine curve, and must not without correction be assumed as the dates of the actual minimum and maximum) varies in an orderly manner, indicating a mean minimum and maximum at about February 20th and August 20th, from 3° E. to 4° E., with somewhat earlier dates to the westward and eastward of these limits (Fig. 5). The acceleration

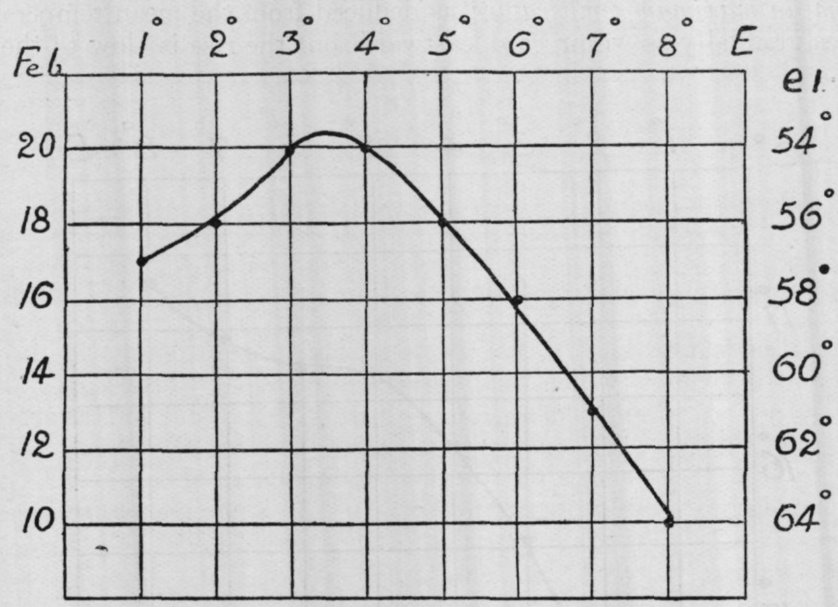

FIG. 5.—Mean phase angle of the fundamental sine-curve (or approximate date of mean annual minimum temperature) between the Humber and the Elbe (1877–1883).

of date is slight, about three days only, at 1° E., our nearest station to the English coast; but it increases rapidly as we approach the German coast, and amounts to an acceleration of about ten days in the neighbourhood of Helgoland. It would be more correct to speak, conversely, of an increasing retardation of seasonal temperature compared with true mid-winter, as we depart from the coast, and an increased retardation likewise in the neighbourhood of the insular coasts as compared with the continental.

(6.) It is interesting to investigate how far, and with what degree of regularity, the mean monthly temperature, as deduced from the simple sine curve, differ from the means of the monthly observations. This difference is to all intents and purposes represented by the factors (A_2, e_2) of the second harmonic, which we have calculated out and set forth in the tables. The higher harmonics are represented by very small and vanishing waves, which we have not recorded, for the double reason that our observations are not accurate enough or frequent enough to indicate them in a satisfactory manner, even if they actually exist, and also because we are not in a position to connect them, if we did prove their existence, with a physical cause. But the case is in so far different with the second sine-factor, or semi-annual wave, in that it always is represented by a factor of considerable amount, and by one which varies on the whole in an orderly way; and we must accordingly presume that it has a definite physical cause, though what that cause is has not yet, so far as I am aware, been determined. While the factor A_1, or half-range of the semi-annual wave, differs considerably in different years, and gives us only a moderately smooth curve for the different stations in each single year (as we might indeed expect from the roughness of our observations, and the small magnitude of the phenomenon), yet for the mean of our seven years it is found to vary very regularly from one end of our route to the other, being fairly constant at about ·5° C. from 1° to 4° E., and then rising rapidly to a maximum of about ·8° C. at 7° E. longitude; at our farthest eastward station near Helgoland it falls slightly (Fig. 6).

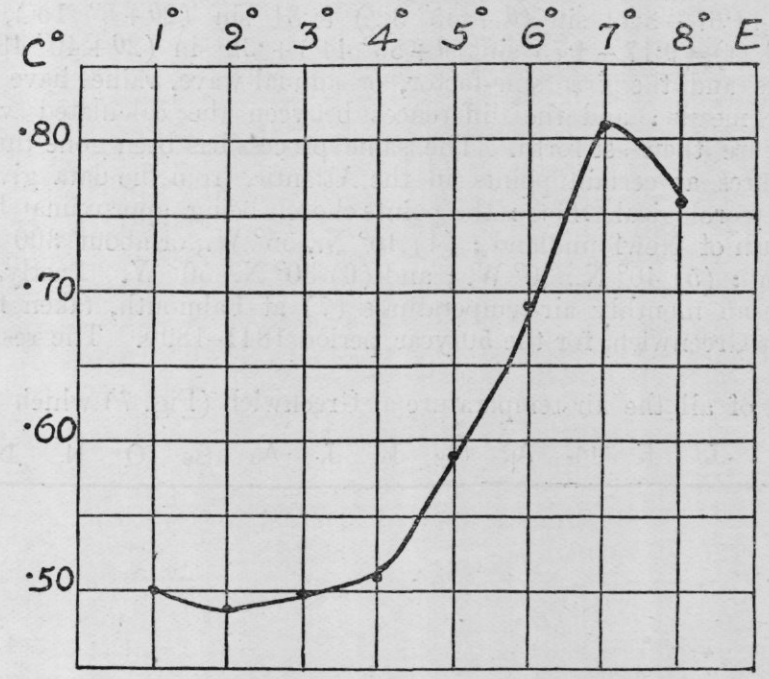

FIG. 6.—Mean value of the factor A_2, or mean of the semi-annual sine-curve of surface temperature, along a route from the Humber to the Elbe (1877–1883).

(7.) It is already well-known that we must take into account this second harmonic in order to obtain a formula which shall give a sufficiently close approximation to the ordinary annual periodic changes of air-temperature. For example, Hann, in his Lehrbuch der Meteorologie (1906), p. 567, shows that, in representing the annual periodic temperatures at Graz by means of a harmonic formula, the inclusion of this second factor, or semi-annual wave, which has there an amplitude of ·70° C., is necessary, and is quite sufficient to give a perfectly adequate approximation to the actual mean daily temperature. It is therefore a phenomenon not peculiar to sea-temperatures, but common to air-temperatures also, at least in temperate zones. For the present, in our case, remembering that the higher harmonics are apparently insignificant, the simplest method of dealing with the phenomenon will be to investigate directly the differences between the monthly means obtained from the observations and the monthly means as taken from the symmetrical annual wave that is given by the first sine curve.

In our former Report we found in dealing with this subject, from the observations made in 1905, that in the case particularly investigated, namely the surface temperatures in the neighbourhood of Helgoland, the observed means were somewhat higher both in summer and winter, and somewhat lower both in autumn and spring, than the sine-formula indicated. The same phenomenon is extremely clear at all points of the line of stations of which we are now treating; and Table V. contains the mean monthly discrepancies for each and all of the eight stations (1° E.—8° E.) during the years

1877–1883. These figures represent a curve with a double maximum in February and in August or September, of which the former is the higher; and a double minimum about April–May and October–November, of which the former is usually the lower. As the maxima of this curve coincide generally with the seasons of minimum and maximum temperature it follows that the temperature never falls quite so low in winter, and rises somewhat higher in summer, than it would do were the whole annual fluctuation governed simply by the fundamental sine curve. We may interpret it in yet other words by saying that the actual temperature rises somewhat too slowly from its minimum and somewhat too quickly towards its maximum, falling likewise too quickly from the maximum and too slowly as it approaches the minimum; that is to say *it fluctuates too quickly when in the neighbourhood of the maximum and too slowly when in the neighbourhood of the minimum.* The phenomenon is *a change in the rate of change* of temperature.

(8). As this phenomenon is of considerable interest, I have enquired a little further into it in several cases. Firstly, I have taken from Mr. H. N. Dickson's paper on 'The Mean Temperature of the Surface Waters of the Sea round the British Coasts'* the values there given for the mean monthly surface-temperature of the sea at (among other stations) (1) Falmouth (1872–85) and (2) the Outer Dowsing (1880–97). These monthly values have been analysed into a sine-curve, the value of which for Falmouth is (in centigrade degrees) $f(t) = 11{\cdot}67 - 3{\cdot}44 \sin(\theta + 55^\circ\,32') + {\cdot}31 \sin(2\theta + 6^\circ\,15')$, and for the Outer Dowsing $f(t) = 9{\cdot}17 - 4{\cdot}73 \sin(\theta + 53^\circ\,44') + {\cdot}32 \sin(2\theta + 40^\circ\,43')$. From the mean-temperature and the *first* sine-factor, or annual wave, values have been calculated for the monthly means: and the differences between the calculated values and the observed values are then set forth. The same process has been gone through for mean surface-temperatures at certain points in the Atlantic, from the data given in the Pilot Charts of the Meteorological Office: the points chosen being approximately (3) 45° N., 55° W., just south of Newfoundland; (4) 40° N., 55° W., or about 300 miles south of the former station; (5) 40° N., 30° W.; and (6) 30° N., 50° W. Lastly, similar results are given for mean monthly air-temperatures (7) at Falmouth, taken from Dickson's paper, and (8) at Greenwich, for the 50-year period 1841–1890. The results are shown in Table VI.

Taking first of all the air-temperature at Greenwich (Fig. 7) which is based on the

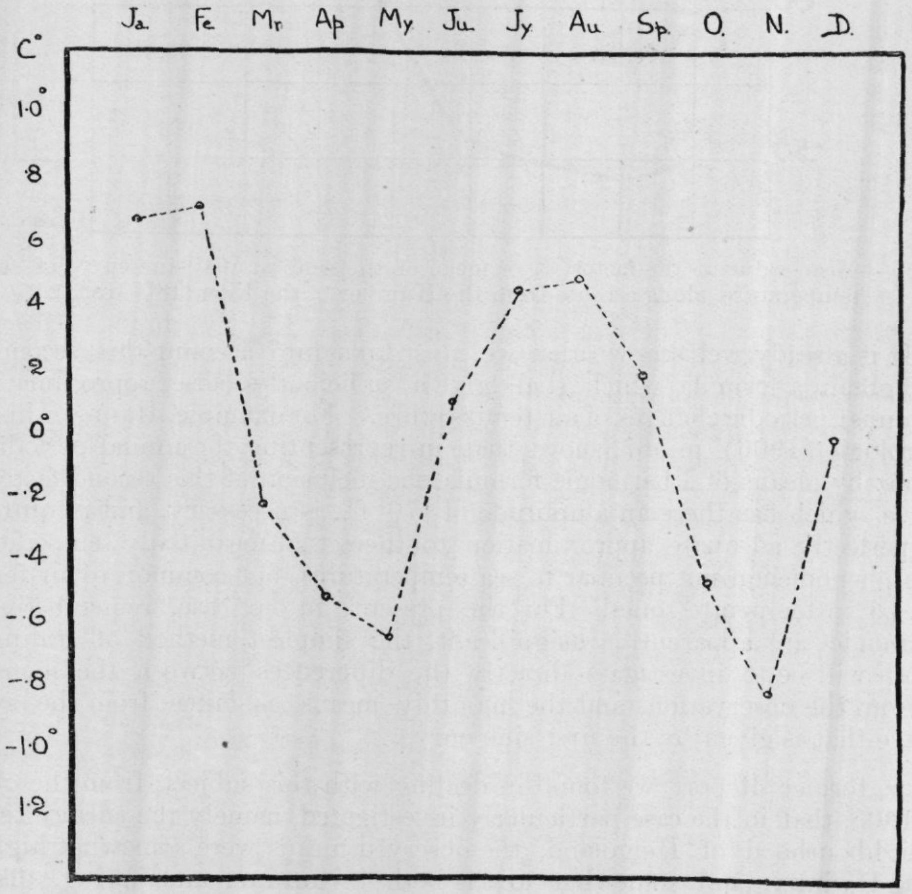

FIG. 7.—Differences between mean monthly air-temperatures at Greenwich as deduced from observations, and as calculated from the fundamental sine-formula.

* Quart. Journ. R. Meteor. Soc., xxv. Oct. 1899.

mean of fifty years' accurate observations, we see that the mean monthly discrepancies from the annual sine-curve form a fairly regular wave, with a total amplitude of about 1·2° C., and with maxima in February and August. The curve for the air-temperatures at Falmouth is not very different from that at Greenwich in respect to phase, but the two semi-annual waves are more markedly unequal, the winter maximum being higher and the summer maximum much lower than in the Greenwich curve.

Next, the curve taken from the sea-temperatures at the Outer Dowsing (1880–97) corresponds closely with those which we have obtained from the more easterly stations on the Hull to Hamburg route, which route indeed passes close by the said lightship (Fig. 8).

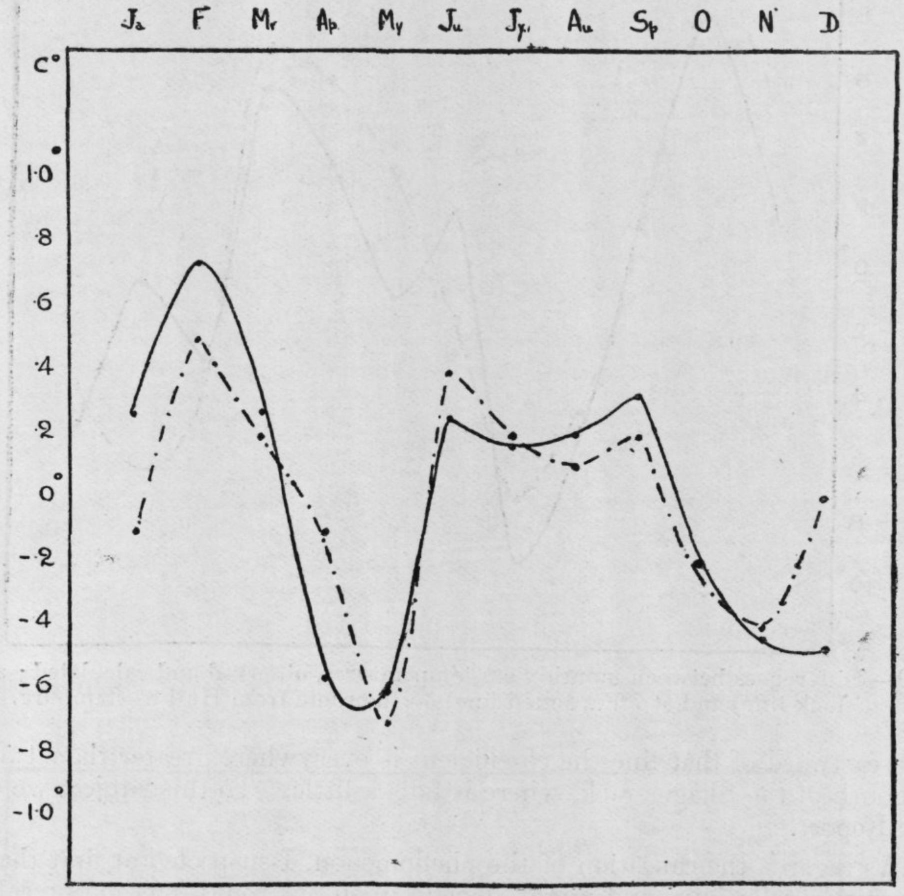

FIG. 8.—Differences between mean monthly sea-temperatures, observed and calculated. At 3° E. on the route from Hull to Hamburg, 1877–1883 (thick line); at the Outer Dowsing, 1880–1897 (dotted line).

A minor feature is reproduced in both curves, viz., a secondary maximum in June, interrupting the ascent of the curve from the April or May minimum to the September maximum; this feature of the curve gradually diminishes as we go eastward along the Hull-Hamburg route, disappears at 6° and 7° E. (Fig. 9), but shows a tendency to reappear at 8° E. At Falmouth, where by the way the observations are doubtless taken in sheltered water, the range for sea-temperature is a little less than at the Outer Dowsing, but the curves are on the whole similar.

Of the Atlantic curves (Fig. 10) that for 40° N., 30° W., near the Azores, has the smallest amplitude; it closely resembles, save for a slight difference in phase, our curve for 7° E. between Hull and Hamburg. In 30° N., 50° W., the curve is again similar, but with somewhat greater amplitude. At 40° N., 55° W., there is a marked difference in the form of a very low minimum in June, so low as to suggest the possibility of an error in the mean temperature assigned to that month. Lastly, a little south of Newfoundland, in 45° N., 55° W., where the mean annual surface-temperature is only 7·4°, and the total annual range about 14°, we have a small and regular curve with total amplitude of nearly 3°, the largest amplitude that we have come across in this connection.

Furthermore, I have plotted upon a chart (not here reproduced) all the values of A_2 given in our former volume of Hydrographic Reports (1904-1905) for various stations in the North Sea during the year 1905, with the interesting result that this factor is found to vary locally in a very regular way, being small everywhere off the Scotch coast, and increasing as we go eastward. If we take a line from the neighbourhood of Bergen to Newcastle, this co-efficient is less than 1·0° C. everywhere in the North Sea to the westward of that line and greater everywhere to the eastward of it; while if we draw a second oblique line parallel to the former from the neighbourhood of Stavanger to Flamborough

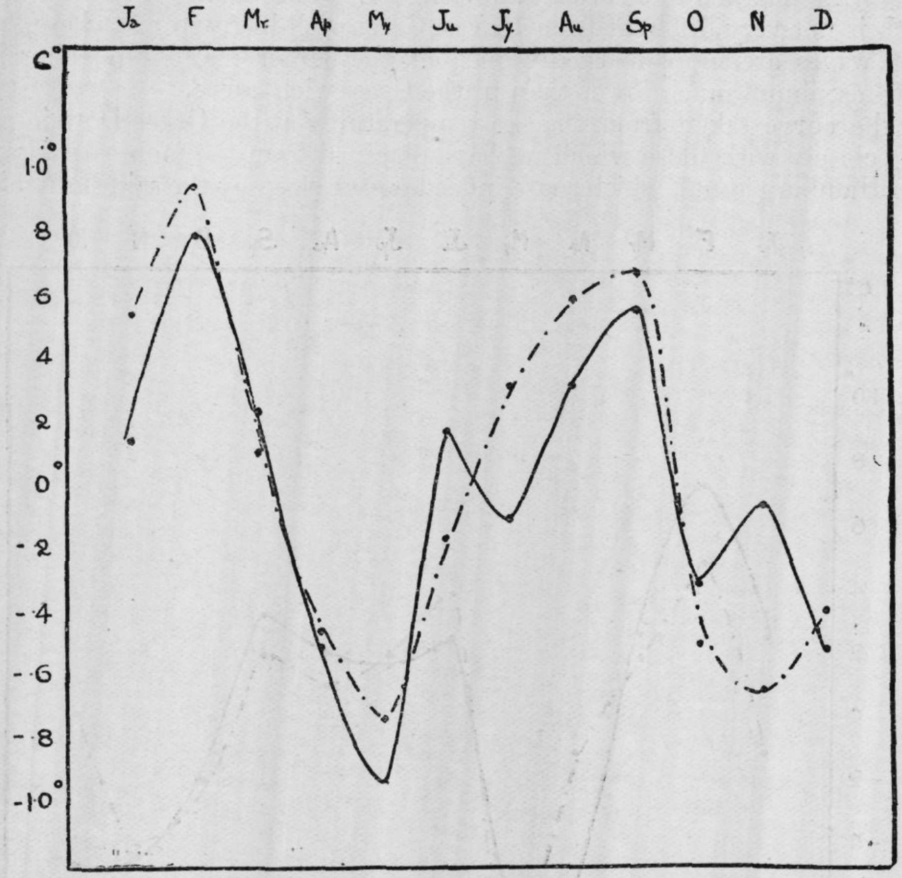

FIG. 9.—Differences between monthly sea-temperatures, observed and calculated; at 1°E. (thick line) and at 7°E. (dotted line) on the route from Hull to Hamburg.

Head, then eastward of that line the co-efficient is everywhere greater than 1·5° C., except near the mouth of the Skager-rack, where it falls a little. To this subject we shall return in another Report.

(9.) As regards the causation of the phenomenon, I suspected at first that the thing might be entirely fallacious, and might depend upon our rough method of calculation, in which we omit to correct for the inequality of the months. This is certainly not the case; the correction for the calendar dates is smaller in amount, and quite different in its nature from the discrepancy with which we are now dealing; it scarcely affects the amplitude, and makes but a trifling difference in phase. It next appeared to me to be possible that a physical cause might be found in the seasonal change in the amount of wind, and in the greater amount of mixing of the waters which takes place in winter owing to the action of waves as compared with what goes on in the calmer seas of summer. Assuming this to be the case, the warming influences in summer are, so to speak, expended upon a more superficial layer of the sea, while the cooling influences of winter affect a larger or deeper body of water; and the result should be just such as we have observed, namely, a retardation of temperature-change in the surface layers during the stormy season of winter, and a comparative acceleration of temperature-change during the calmer weather of summer-time. A similar explanation is equally conceivable in the case of atmospheric temperatures, and it is probable that it has some effect, and certain that its effect, if any, is in the required direction; but this explanation fails to meet the case, or to account adequately for the phenomenon in question. There are two obvious reasons why it is inadequate: firstly, while to the north of the Dogger Bank it is found to be the case that the temperature of the North Sea is practically identical from surface to bottom in the winter-time, but much hotter in the surface than below in summer-time, yet, on the other hand, to the southward of the Dogger Bank this seasonal difference does not exist, for tidal and other currents are at all seasons sufficient to intermix the waters, and to give an identical, or almost identical, temperature from surface to bottom. Secondly, the above explanation quite fails to account for the progressive differences that we have found to exist on the route from Hull to Hamburg, and in general from the west to the east sides of the North Sea. The true explanation probably lies in some simple meteorological phenomenon, probably connected with the direction as well as the force of prevailing winds, but it must be confessed that the problem is as yet unsolved.

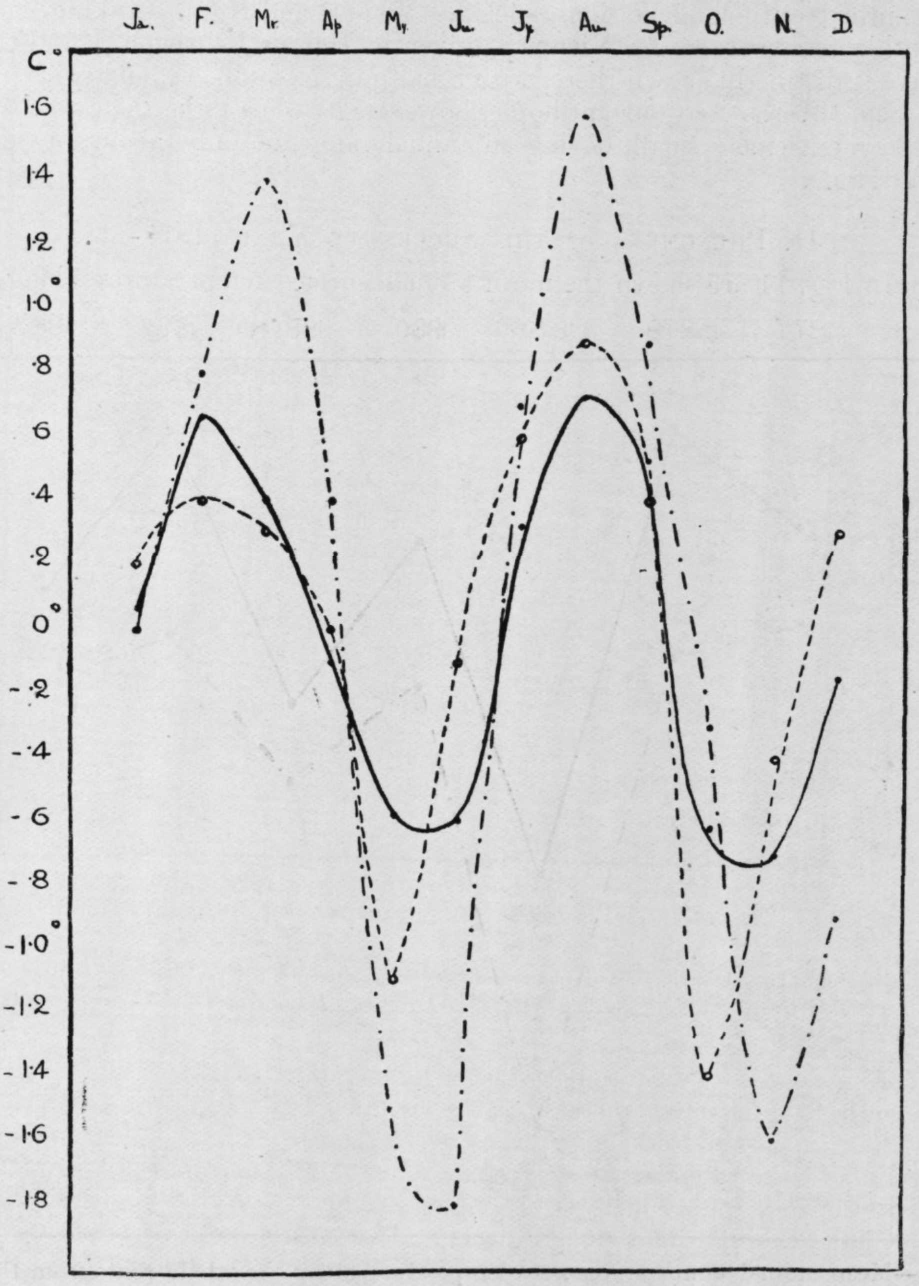

FIG. 10.—Differences between mean monthly temperatures, observed and calculated. Sea-temperatures in Atlantic; at 40° N. 30′ W., near the Azores (thick line); at 30° N. 50′ W. (dotted line ------); at 45° N. 55′ W., south of Newfoundland (dotted line —.—.—).

(9A.) Since the rest of this paper was completed I find that the question of the semi-annual wave has already been discussed by Dr. W. N. Shaw and Mr. R. W. Cohen, in a paper on "The Seasonal Variation of Atmospheric Temperature in the British Isles and its Relation to Wind-direction, with a Note on the Effect of Sea Temperature on the Seasonal Variation of Air Temperature."*

These authors give a clear account of the phenomenon, and show that it is independent of the relative frequency of occurrence of cyclonic and anticyclonic weather. They consider that it is partly due to a periodic variation in the relative frequency of "cold" "warm" and "temperate" winds, the lowering of temperature in May, and to some extent in November, being (for instance) synchronous with a marked increase of cold northerly and easterly winds. They show also that a similar periodic variation of the second order is found in the case of the magnitude of the barometric gradient between London and Valencia and between London and Aberdeen, those gradients showing well-marked maxima about the middle of January and the middle of July; and they consider it

* Proc. Roy. Soc., Vol. LXIX., pp. 61–85, 1902.

probable that this periodic variation in pressure plays some part in causing the similar variation in temperature.

They state that this semi-annual variation is not found, with maxima at the same epoch, in purely continental stations, such as Vienna and Agra. Taking, however, the mean monthly temperatures for Vienna as given in Hann's Lehrbuch, I find that a semi-annual wave is distinctly shown there, with a half-range of ·53° C., and with maxima in April and September. At Constantinople, however, it seems to be the case that the semi-annual wave is extremely small, having an annual range of only about one-eighth of a degree Centigrade.

II. Phenomena of the Successive Years 1877–83.

(10.) In Fig. 11 are shown the mean annual surface temperatures along our route

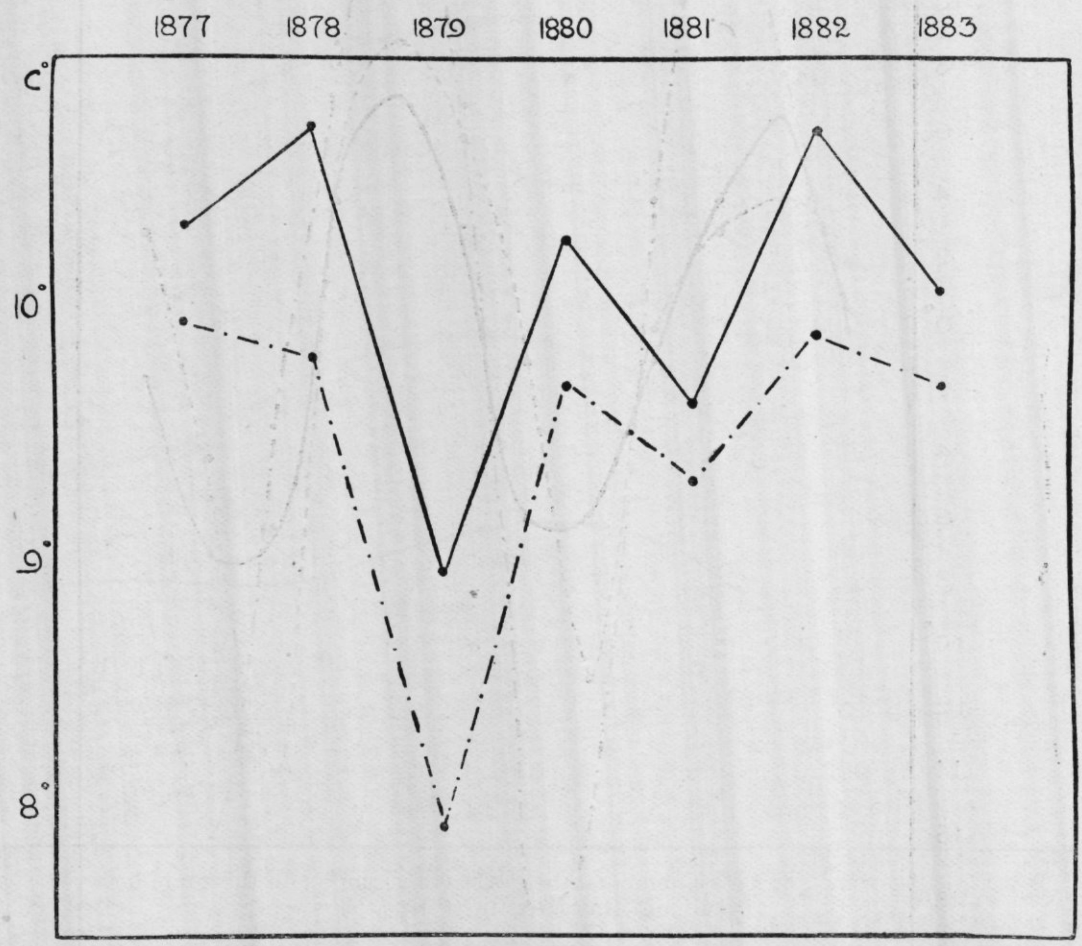

FIG. 11.—Mean annual temperatures: sea-temperature along the whole route from the Humber to the Elbe (thick line); air-temperature at Greenwich (dotted line).

from 1° to 8° East for the years 1877–1883, and side by side with them are plotted the mean air-temperatures at Greenwich for the same years. It will be seen that the two series are closely parallel. The mean excess of sea-temperature over air-temperature over the whole seven years was ·65° C.; and the greatest discrepancy was in the very cold year 1879, when the mean sea-temperature was 1·5° above the mean air-temperature at Greenwich. Comparing, in the next place, the Greenwich air-temperatures with the surface-temperatures at our nearest station to the English coast, namely in 1° East, the mean difference is only ·11° Centigrade, and the greatest discrepancy is again in the year 1879, when the sea-temperature was ·41° in excess of the Greenwich air-temperature. This is, on the whole, in conformity with the result arrived at by Mr. Dickson in his paper already quoted, viz., that on the East Coast of England the mean annual temperature of the sea-surface is ·2° F. in excess of the air-temperature, a difference which, however, is much exceeded on our southern and western coasts. In 1877 and in 1881 the mean temperature of the surface water would appear to be slightly below the air-temperature at Greenwich, but our results, especially at this most easterly station, are far from being exact enough to let us be certain upon this point. The mean annual surface-temperature of the sea and the mean annual temperature of the air on land show at least such marked correspondence that, so far as surface-temperature by itself is or is likely to be a factor influencing, for instance, the Herring fishery, we may evidently draw approximate conclusions as to how that surface-temperature has varied in past years simply from the air-temperatures, regarding which our information is so much more abundant and accurate. Moreover, since it has been shown that in the southern part of the North Sea, south of the Dogger Bank, the sea-temperature is nearly constant from surface to bottom, we may say that the air-temperature gives a very considerable clue at least to the mean annual temperature of the whole of this part of the sea.

(11.) In Fig. 12 are shown side by side the mean annual temperatures at all points

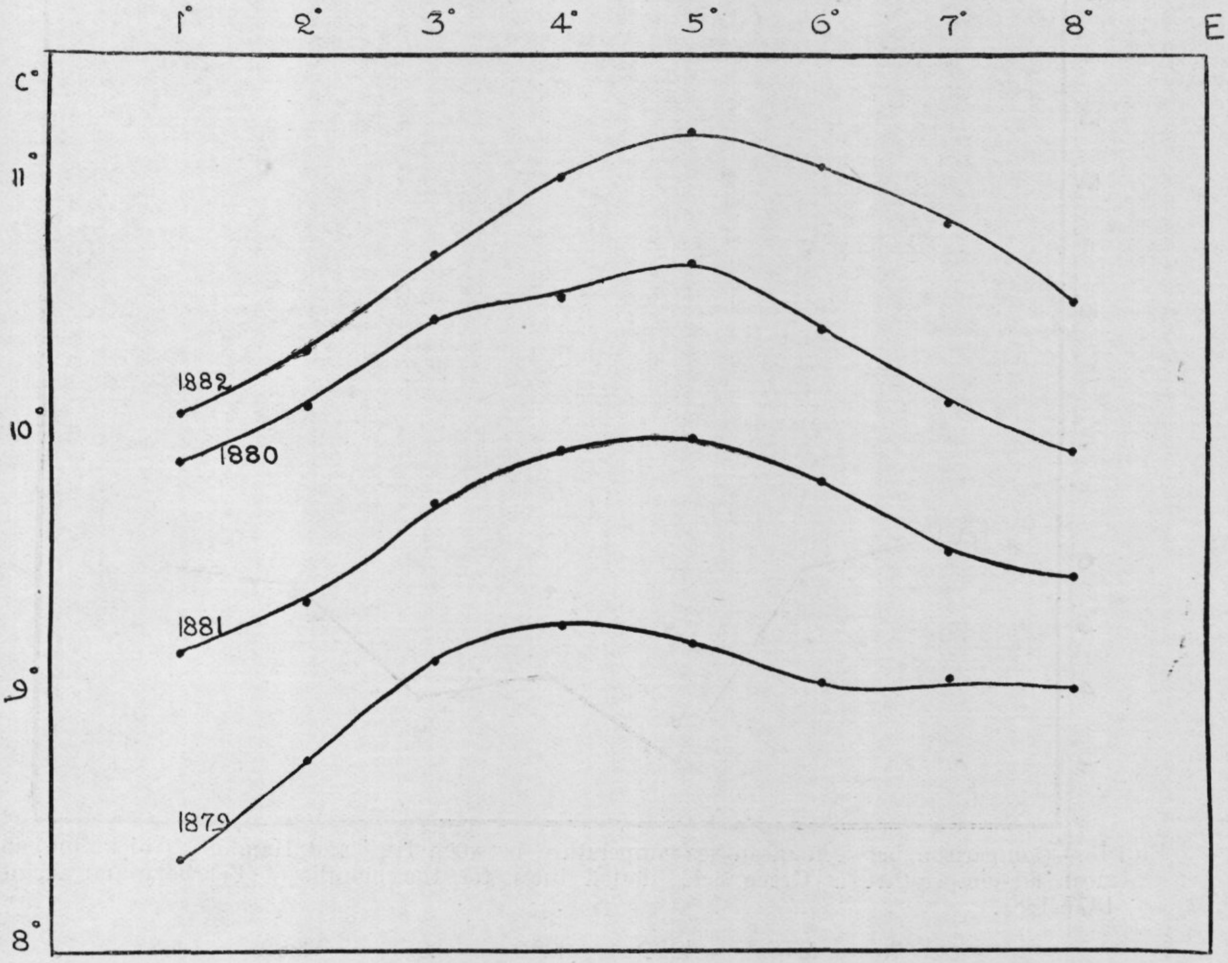

FIG. 12.—Mean annual sea-temperature at successive points on the route between Hull and Hamburg, in various years.

along our route for four out of the seven years which we have studied. It will be seen that the curve is very much the same in all years, the mean temperature being lowest at the western or English end of the route and highest somewhere near the middle : but we see, or seem to see from this figure, the further fact that the point of highest mean temperature is shifted somewhat further to the westward the lower the mean temperature of the year.

(12.) When we compare month by month, instead of merely year by year, the Greenwich air-temperatures with the mean surface-temperatures along our route we still see, for the most part, but with certain striking exceptions, a close correspondence between them. This correspondence will be best exhibited by drawing curves for each separate month during the successive years for which we have observations at sea.

We then find, in the first place, that in the months of February and August (Fig. 13) the Greenwich air-temperature is always nearly identical with the mean sea-temperature. On the other hand, as Mr. Dickson has shown, from March to July (or longer) the sea-temperature, rising more slowly, is always much below the air-temperature, while from September to January it is, conversely, considerably above the air-temperature. This marked difference is illustrated by curves drawn for the months of April and October (Fig. 14).

The phenomenon is a simple corollary to the facts that the annual waves of air-temperature and of sea-temperature are both approximately sine-curves, that their means and amplitudes are approximately identical, and that the former precedes the latter in

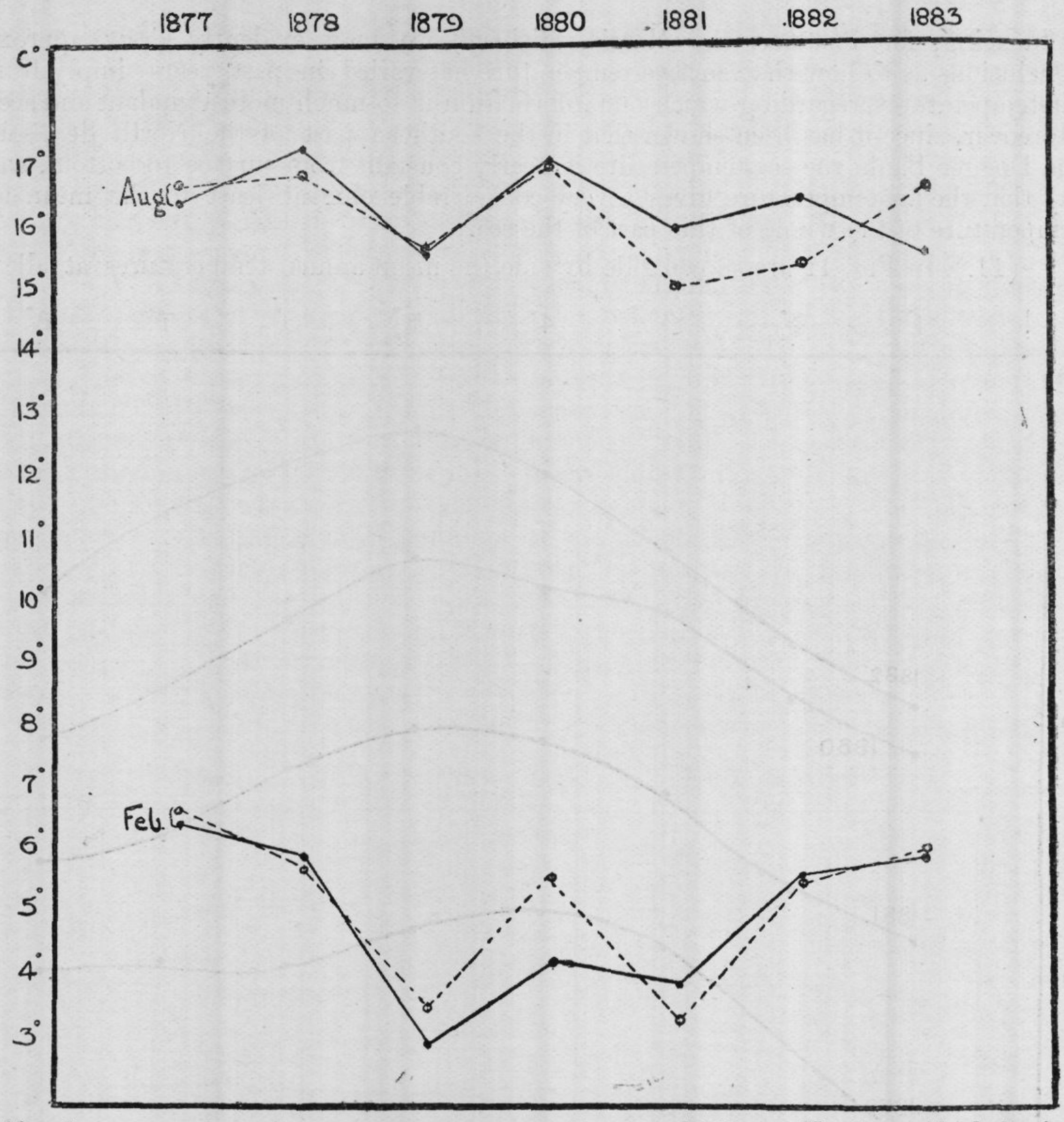

FIG. 13.—Comparison between mean sea-temperature between Hull and Hamburg (thick line) and mean air-temperature at Greenwich (dotted line), for the months of February and August 1877–1883.

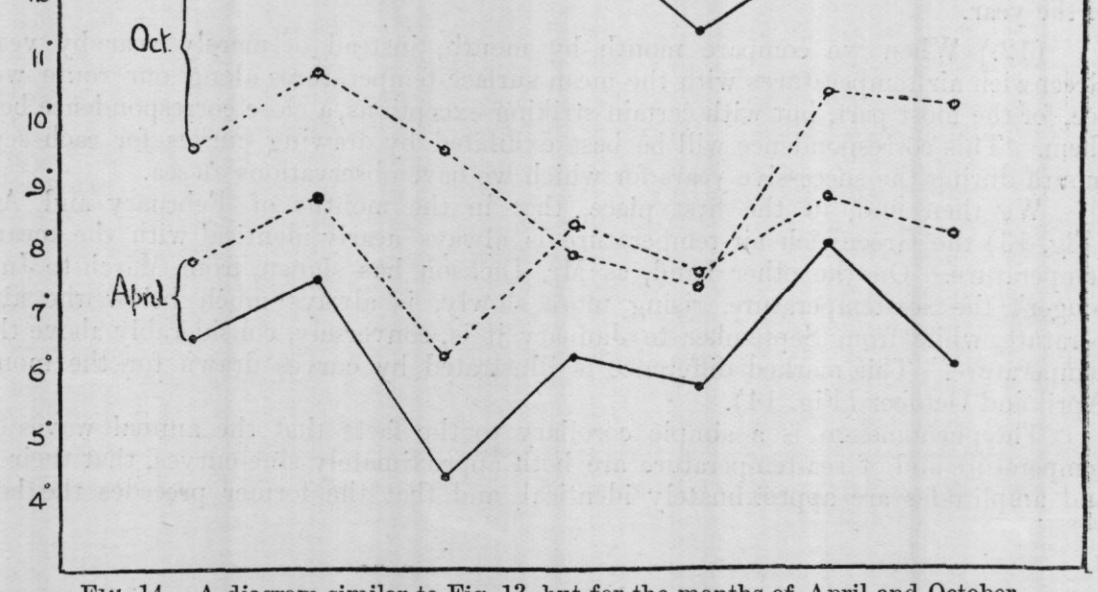

FIG. 14.—A diagram similar to Fig. 13, but for the months of April and October.

phase by about three weeks. We may easily determine the nodes, or dates when the two temperatures are identical, by equating the two sine-formulæ for air- and sea-temperature. Doing this with our formulæ for air-temperature at Greenwich and for sea-temperature at the Outer Dowsing, we find that the two temperatures are equal at or about February 12th and August 12th, and that from the former to the latter date the sea-temperature is in excess—a result which is subject to further correction on account of the second harmonic. It is plain that if the *amplitudes* of the two waves were markedly unequal the periods during which the sea-temperature is above and below the air-temperature would still last for one-half the year, but would be transposed to very different seasons.

On the other hand, if the mean temperatures be markedly dissimilar, then it may well happen that the two curves will never intersect; and this is the case, to judge from Mr. Dickson's figures, with the air- and sea-temperature of the west of Ireland, where the phase is practically identical, but the mean sea-temperature is about ·8° C. above that of the land; the amplitudes differ by about ·3° C. If in this case we equate the two formulæ, we arrive at an impossible result, and, as a matter of fact, observation shows that the sea-temperature is in excess of the air-temperature all the year round.

While in nearly all cases the curves for air and sea-temperature run approximately parallel to one another, yet on the whole we find, as we might naturally expect, that the fluctuations of the mean air-temperature are somewhat greater than those of the mean sea-temperature. And in two instances, namely, in July and in November, 1881, we have abnormally high mean air-temperatures which are not in the least degree repeated on the sea-temperature curves (Fig. 15). Both were exceptional months: November, 1881, was the warmest November at Greenwich, with two exceptions, for 110 years, while

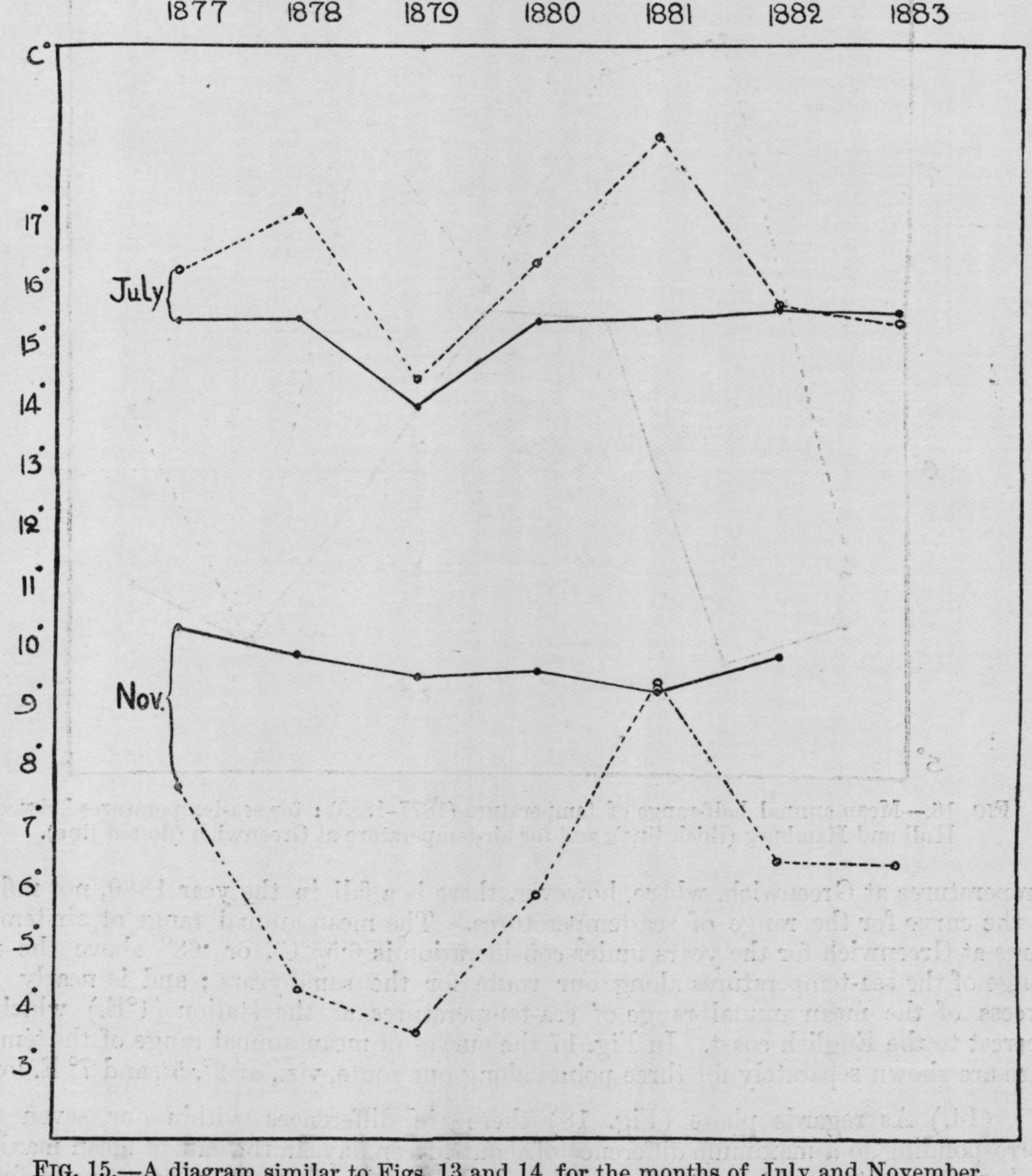

Fig. 15.—A diagram similar to Figs. 13 and 14, for the months of July and November.

July, 1881, was also extraordinarily hot, but not uniformly so, for in the west and south-west of England it was rather below the average. It is noteworthy that October, 1881, which was an exceptionally cold month, shows its low temperature both upon the air curve and upon the sea curve, while the high temperature of the immediately following November is only indicated on the former.

The same curves (if we complete the series for the remaining months) will be found interesting in comparing the characters of the various years. In 1879, which was on the average the coldest year of our series, its exceptionally low temperature is reflected in every month until September, but from September onwards the monthly temperatures are as low, or lower, in certain other years. In 1881, which is the next coldest year, on the average, of our series, every month, with the exception of December, is again more or less exceptionally cold, and September and October are remarkably so. The year 1878, which is by a little the hottest year of the series, owes its high mean temperature chiefly to the spring and autumn months, the range of temperature being below the average in that year; and the same is the case in 1882, when the mean temperature was again high, and the range low.

(13.) The mean annual range of temperature (deduced as usual from the fundamental sine curve) is highest for the year 1879 and 1880, of which the former was the coldest year of the series, and lowest for the years 1877, 1878, and 1882, which were the three hottest (Fig. 16). The variation from year to year is on the whole similar in the air-

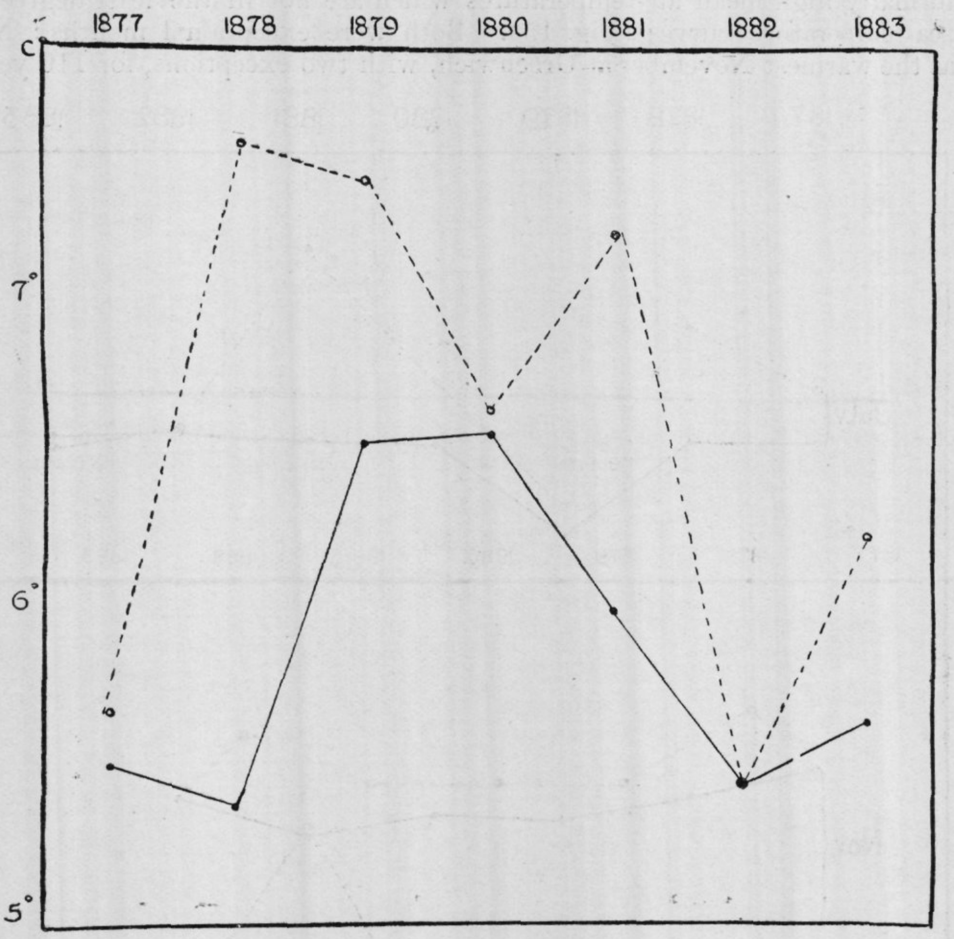

FIG. 16.—Mean annual half-range of temperature (1877–1883): for sea-temperatures between Hull and Hamburg (thick line), and for air-temperature at Greenwich (dotted line).

temperatures at Greenwich, where, however, there is a fall in the year 1880, not reflected in the curve for the range of sea-temperatures. The mean annual range of air-temperatures at Greenwich for the years under consideration is 6·55°C, or ·68° above the mean range of the sea-temperatures along our route for the same years; and is nearly 2° in excess of the mean annual range of sea-temperatures at the station (1°E.) which lies nearest to the English coast. In Fig. 17 the curves of mean annual range of the temperature are shown separately for three points along our route, viz., at 2°, 5°, and 7° E. long.

(14.) As regards phase (Fig. 18) there are differences within our seven years corresponding to a maximum difference of about fifteen days in the date of mean maximum and minimum temperature (so far as the fundamental sine curve is concerned) for our

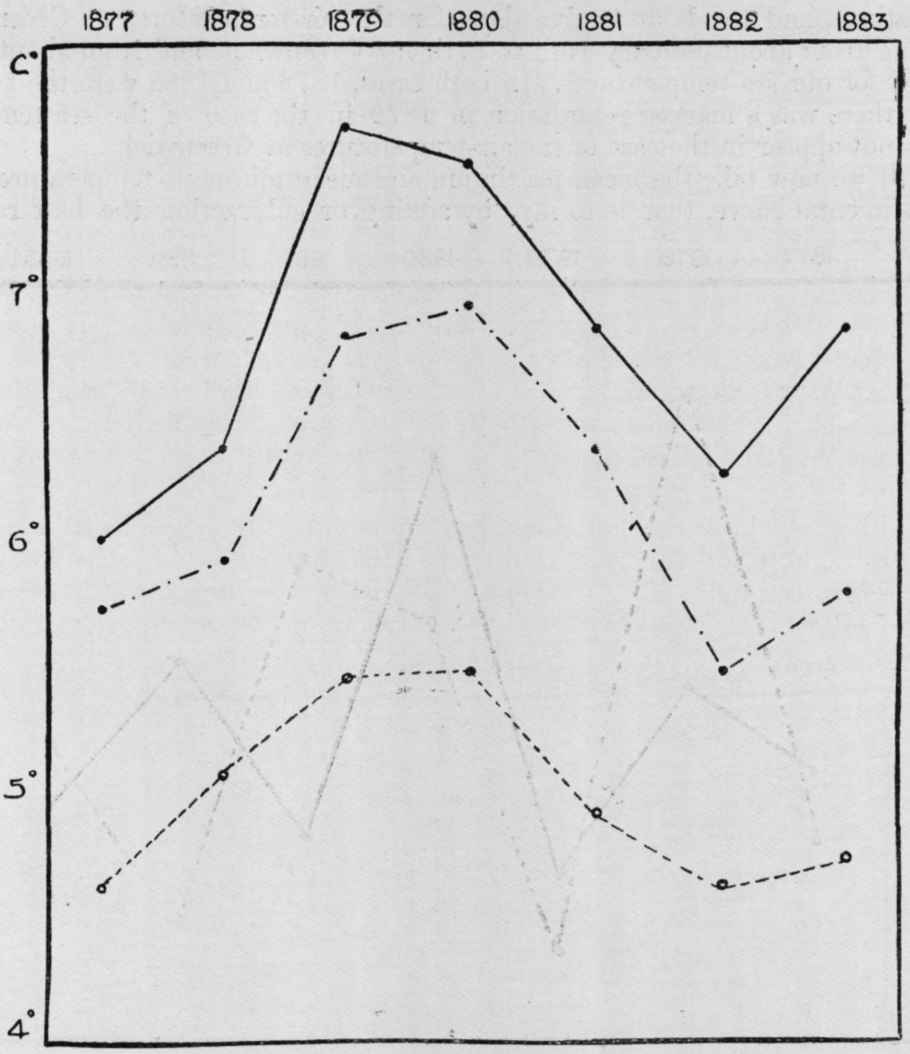

FIG. 17.—Mean annual half-range of sea-temperature (1877–1883), at points on the route between Hull and Hamburg: at 7° E. (uppermost curve), 5° E. (middle), and 2° E. (lowermost curve).

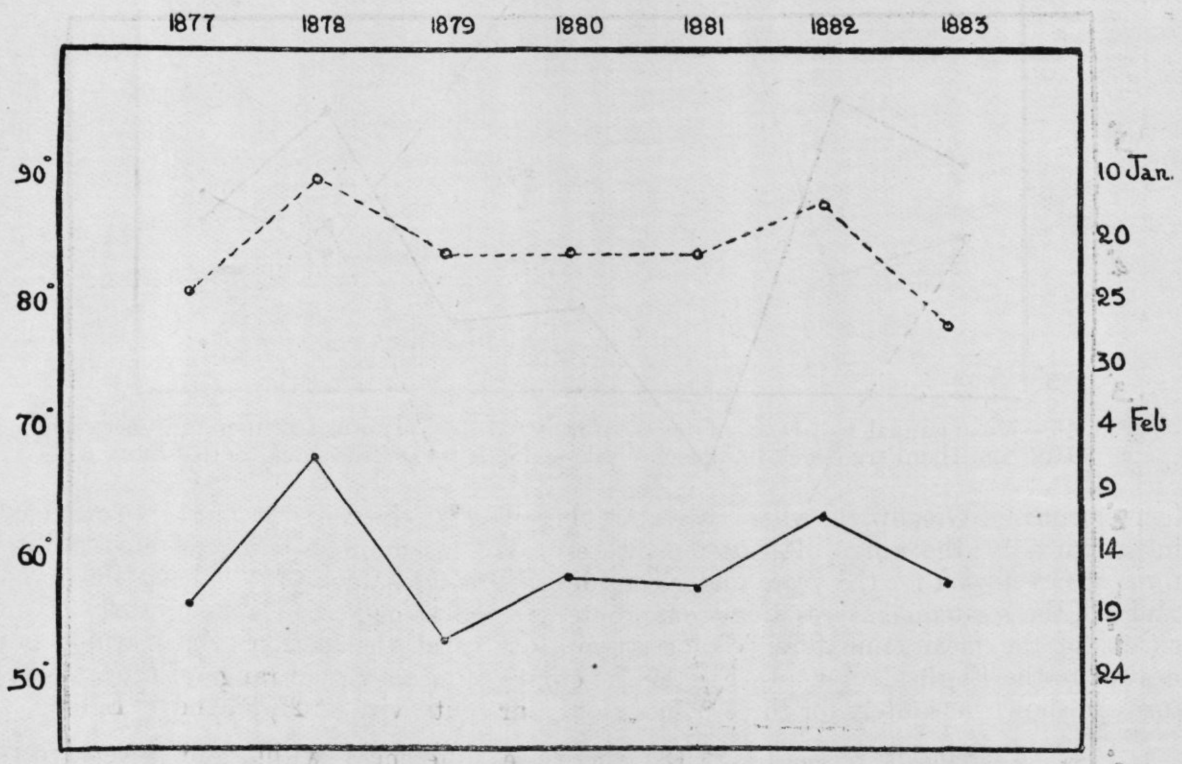

FIG. 18.—Diagram showing phase differences for successive years between sea-temperatures along our route (thick line), and air-temperatures at Greenwich (dotted line). The dates correspond to the epoch of minimal temperature, as determined by the fundamental sine-curve.

sea-temperatures, and to about twelve days for the air-temperatures at Greenwich, the periods being from about January 15th to 27th for Greenwich, and from about February 11th to 21st for our sea-temperatures. In both cases, 1878 and 1882 were the two earliest years; but there was a marked retardation in 1879 in the case of the sea-temperatures, which does not appear in the case of the air-temperatures at Greenwich.

(15.) If we now take the mean maximum and mean minimum temperatures as given by the funadmental curve, that is to say, by adding or subtracting the half range to or

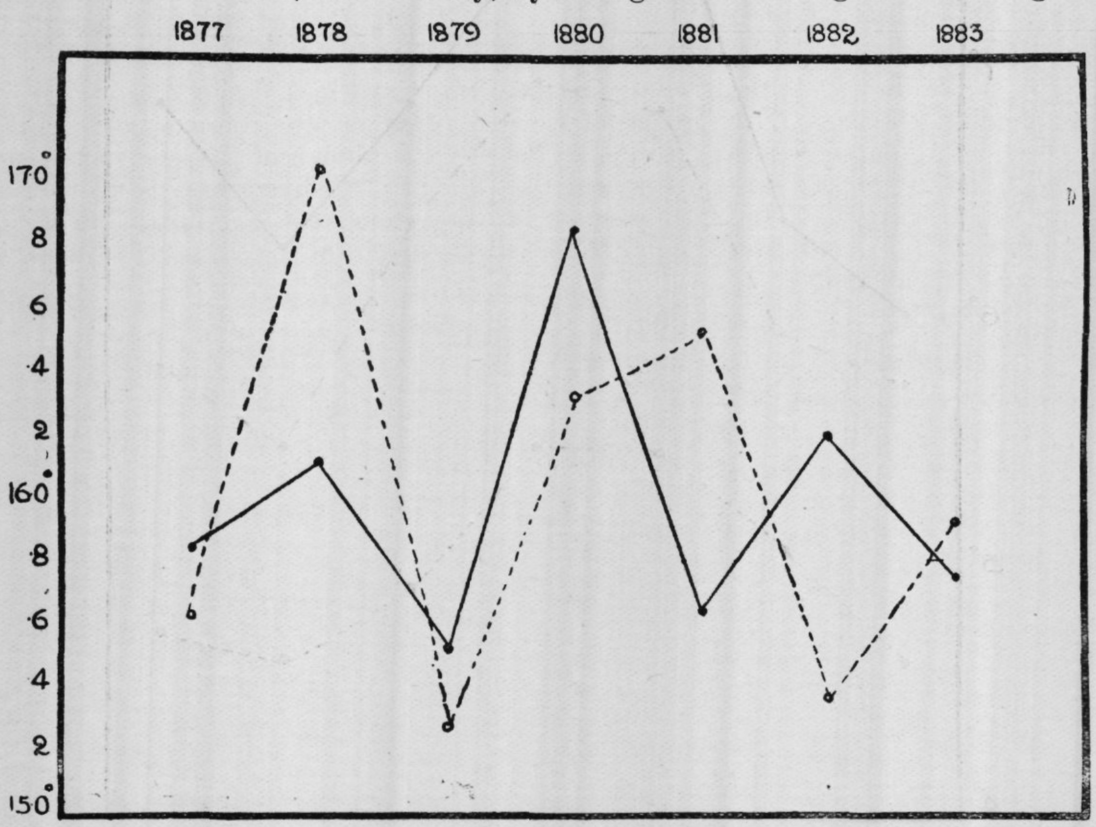

FIG. 19.—Mean maximum temperatures in successive years: sea-temperature between Hull and Hamburg (thick line), air-temperature at Greenwich (dotted line).

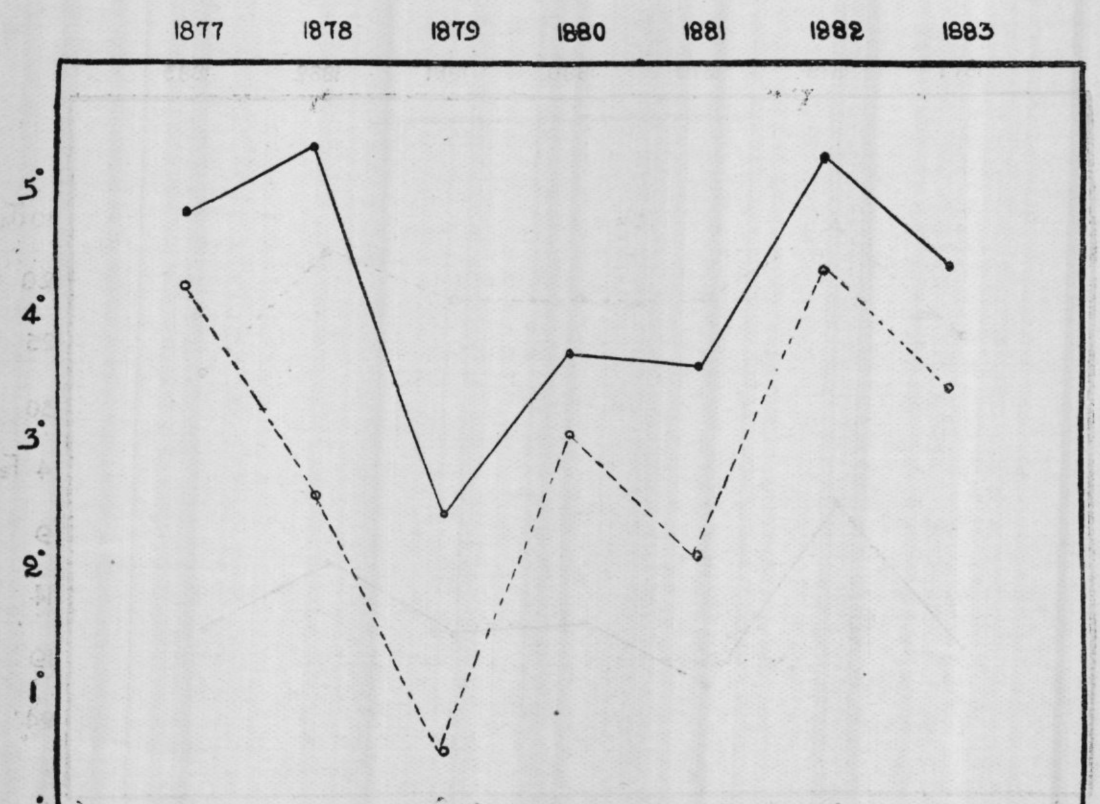

FIG. 20.—Mean minimum temperatures in successive years: sea-temperature between Hull and Hamburg (thick line), air-temperature at Greenwich (dotted line).

from the mean temperature of the year, we find a striking difference between the two as regards the relations of the sea and air-temperatures.

In the case of mean maximum (Fig. 19) there is no constant difference between the results for the Greenwich air-temperatures and for our sea-temperatures during the seven years. The two curves for the successive years intersect one another, and while during five out of the seven years they seem to vary consistently, during the other two they fail to agree, seeming rather to vary in inverse relation to one another. The extreme variation in the case of the sea-temperatures is about 1·3° C., and that of the air-temperatures about 1·7°.

(16.) In the case of the mean minimum temperatures (Fig. 20) the total variation is larger, amounting to about 4° in the case of the Greenwich air-temperatures, and about 3° in the case of our sea-temperature ; secondly, the mean minimum of the sea-temperatures is about 1·3° higher for the sea-temperatures than for the air-temperatures ; and, thirdly, with one slight exception, the two phenomena vary from year to year in an almost identical fashion. In both cases the minimum was by much the lowest in 1879, and was highest in 1878 and 1882.

TABLE I.

HULL TO HAMBURG. MONTHLY MEAN SEA-TEMPERATURES AT SURFACE, 1877–1883

Longitude E.	1°	2°	3°	4°	5°	6°	7°	8°	Mean.
1877.									
January	5·8	6·0	6·0	6·0	5·8	5·5	4·9	4·4	5·55
February	7·1	7·0	6·9	6·6	6·3	6·1	5·9	5·6	6·44
March	6·1	6·1	6·0	6·0	5·8	5·6	5·1	4·8	5·69
April...	6·7	6·8	6·9	6·7	6·6	6·6	6·2	6·5	6·63
May	8·5	8·4	8·4	8·7	8·7	8·8	8·8	8·7	8·63
June	12·3	12·8	13·2	13·6	14·1	13·7	13·8	14·7	13·53
July	13·6	14·5	15·1	15·6	15·8	16·1	16·5	16·8	15·5
August	14·5	14·9	15·9	16·6	17·1	17·5	17·7	17·4	16·45
September	14·4	14·7	15·0	15·3	15·7	15·9	15·7	15·9	15·33
October	11·4	11·6	12·3	13·1	13·2	12·9	12·7	12·7	12·49
November	9·8	10·5	10·6	11·1	10·8	10·3	10·0	10·1	10·4
December	7·6	7·8	7·8	8·0	8·1	7·6	6·9	6·4	7·52
1878.									
January	5·50	6·30	6·55	6·70	6·40	6·20	6·00	5·10	6·11
February	6·05	6·30	6·30	6·30	6·30	6·05	5·60	4·50	5·93
March	6·00	6·10	6·10	6·10	6·00	5·90	5·60	4·90	5·84
April...	6·70	6·95	7·50	7·70	8·00	8·10	8·00	7·80	7·59
May	9·85	9·95	10·20	10·40	10·50	10·65	10·50	10·40	10·31
June	12·40	12·50	12·90	13·20	13·20	13·40	13·70	14·00	13·16
July	13·70	14·90	15·50	15·70	15·75	16·00	16·20	16·60	15·54
August	15·65	16·20	16·80	17·50	18·00	18·20	18·30	18·40	17·38
September	14·5	15·2	15·9	16·7	17·15	14·45	17·3	17·0	16·03
October	13·1	13·45	14·0	14·5	14·6	14·5	14·0	13·5	13·96
November	9·1	9·85	10·4	10·8	10·9	10·6	9·7	8·5	9·98
December	6·7	8·8	7·5	7·7	7·6	7·0	6·5	5·5	7·16
1879.									
January	4·35	4·7	5·1	5·0	4·8	4·4	4·0	3·3	4·46
February	3·30	3·3	3·4	3·4	3·1	2·7	2·5	2·1	2·98
March	4·00	4·0	3·9	3·5	3·2	2·5	2·0	1·8	3·11
April...	4·90	4·9	4·8	4·6	4·1	4·0	4·0	4·1	4·43
May	7·80	7·7	7·7	7·8	7·8	7·8	8·5	9·0	8·01
June	10·50	10·6	10·9	11·7	12·1	12·2	13·1	14·8	11·99
July	11·90	12·5	13·4	14·0	14·4	15·0	15·5	15·9	14·08
August	13·35	14·2	15·0	15·5	16·1	16·5	17·0	17·3	15·62
September	13·1	13·9	14·8	15·3	15·8	16·1	16·2	16·1	15·16
October	11·75	12·5	13·5	13·9	13·8	13·7	13·3	12·5	13·12
November	9·30	10·1	10·4	10·4	10·0	9·5	8·9	7·9	9·56
December	5·80	6·4	6·6	6·2	5·2	4·2	3·8	3·4	5·20
1880.									
January	5·4	5·7	5·3	5·2	4·8	4·0	3·0	2·4	4·48
February	5·2	5·2	5·5	4·7	4·2	3·6	3·2	2·4	4·25
March	6·0	5·9	5·7	5·6	5·4	5·0	4·4	4·2	5·28
April...	6·6	6·6	6·3	6·2	6·2	6·1	6·0	6·6	6·33
May	9·1	9·1	9·1	9·3	9·3	9·2	9·6	10·8	9·44
June	12·5	12·4	13·6	13·5	13·7	13·7	13·9	14·8	13·51
July	13·7	14·0	14·6	15·3	16·0	16·3	16·3	17·5	15·46
August	15·2	16·0	16·5	16·9	17·5	18·2	18·1	18·8	17·15
September	16·2	16·5	17·2	17·7	18·2	18·1	17·8	17·3	17·38
October	12·2	12·9	13·6	14·1	14·1	13·5	13·4	11·5	13·16
November	9·3	9·8	10·6	10·4	10·3	9·7	9·2	7·6	9·61
December	7·4	7·5	7·7	7·8	7·9	7·8	7·0	5·6	7·34

TABLE I—*continued.*

HULL TO HAMBURG. MONTHLY MEAN SEA-TEMPERATURES AT SURFACE, 1877–1883—*continued.*

Longitude E.	1°	2°	3°	4°	5°	6°	7°	8°	Mean.
1881.									
January	5·4	5·6	5·7	5·4	5·2	4·9	4·5	3·6	5·04
February	4·9	4·8	4·7	4·3	3·8	3·2	2·9	2·4	3·88
March	4·3	4·6	4·7	4·6	4·1	3·8	3·1	2·9	4·01
April...	6·1	6·0	5·9	5·8	5·7	5·7	5·8	6·0	5·88
May	8·6	8·4	8·5	8·6	8·6	8·5	8·5	9·1	8·60
June	12·4	12·6	12·9	12·9	12·8	12·6	12·5	14·1	12·85
July	13·7	13·9	14·9	15·7	16·5	16·4	16·3	17·0	15·55
August	14·4	14·7	15·0	15·9	16·7	17·1	17·2	17·3	16·01
September	13·1	13·7	14·4	15·2	15·7	15·9	16·0	15·8	14·98
October	10·3	10·4	11·9	12·4	12·4	12·3	11·7	10·9	11·54
November	9·0	9·6	9·8	9·9	9·7	9·1	8·9	8·4	9·30
December	7·8	8·0	8·4	8·7	8·8	8·3	7·3	6·1	7·93
1882.									
January	6·9	7·0	7·1	7·2	7·1	6·8	6·1	4·7	6·61
February	5·9	6·1	6·2	6·2	6·1	5·8	4·9	3·9	5·64
March	6·9	6·9	6·9	7·0	6·9	6·8	6·5	6·5	6·80
April...	7·8	7·6	7·8	8·2	8·6	8·7	8·6	8·2	8·19
May	9·6	9·6	9·8	10·4	11·0	11·0	11·1	11·5	10·50
June	11·6	12·1	12·9	13·5	13·8	14·0	14·1	15·0	13·38
July	13·5	14·0	14·6	15·4	16·2	16·7	17·1	17·9	15·68
August	15·2	15·4	16·0	16·6	16·9	17·1	17·5	17·8	16·56
September	15·2	15·4	15·8	16·2	16·6	16·8	16·9	16·6	16·19
October	12·4	12·8	13·3	13·7	13·6	12·8	12·4	11·6	12·83
November	9·7	10·0	10·5	10·7	10·5	9·8	9·4	8·7	9·91
December	6·5	7·3	7·7	7·4	7·2	6·7	5·7	4·2	6·59
1883.									
January	6·8	6·9	7·0	6·9	6·1	5·1	4·2	3·5	5·81
February	6·8	7·0	6·8	6·7	6·0	5·2	4·6	4·1	5·90
March	5·7	5·7	5·6	5·4	5·1	4·5	3·9	3·2	4·89
April...	6·5	6·6	6·6	6·3	6·0	6·0	5·8	5·9	6·21
May	8·7	9·0	9·2	9·5	9·4	9·2	9·4	10·6	9·38
June	11·7	11·7	12·3	12·9	13·0	12·9	13·1	14·6	12·78
July	14·1	14·1	14·6	15·1	15·7	16·7	16·9	17·7	15·61
August	14·2	14·4	14·8	15·6	16·0	16·2	16·8	17·1	15·64
September	14·1	14·4	14·8	15·8	16·2	16·4	16·5	16·3	15·56
MEANS, JANUARY 1877—SEPTEMBER 1883.									
January	5·74	6·03	6·12	6·06	5·74	5·27	4·67	3·86	5·44
February	5·61	5·67	5·69	5·46	5·12	4·66	4·23	3·57	5·00
March	5·57	5·62	5·56	5·46	5·22	4·87	4·37	4.04	5·09
April...	6·47	6·49	6·54	6·50	6·46	6·46	6·34	6·44	6·46
May	8·88	8·88	8·99	9·24	9·33	9·31	9·49	10·01	9·27
June	11·91	12·1	12·67	13·04	13·26	13·22	13·46	14·57	13·03
July	13·46	13·99	14·67	15·26	15·76	16·17	16·40	17·06	15·35
August	14·65	15·12	15·72	16·37	16·9	17·26	17·52	17·73	16·41
September	14·37	14·83	15·42	16·03	16·48	16·24	16·63	16·43	15·80
October	11·86	12·28	13·10	13·62	13·62	13·28	12·92	12·12	12·84
November	9·37	9·97	10·40	10·6	10·4	9·80	9·35	8·53	9·80
December	6·90	7·63	7·62	7·63	7·47	6·93	6·20	5·20	6·95
Year	9·57	9·88	10·21	10·44	10·48	10·29	10·10	9·96	10·12

TABLE II.

HULL TO HAMBURG. MEAN ANNUAL SEA-TEMPERATURES AT SURFACE, 1877–1883.

Longitude E.	1°	2°	3°	4°	5°	6°	7°	8°	Mean.
1877	9·82	10·09	10·34	10·61	10·67	10·55	10·35	10·33	10·34
1878	9·94	10·54	10·81	11·11	11·20	10·92	10·95	10·52	10·75
1879	8·34	8·73	9·13	9·28	9·20	9·05	9·07	9·02	8·98
1880	9·90	10·13	10·48	10·56	10·70	10·43	10·16	9·96	10·29
1881	9·17	9·36	9·73	9·95	10·00	9·82	9·56	9·47	9·63
1882	10·10	10·35	10·72	11·04	11·21	11·08	10·86	10·55	10·74
1883*...	9·77	9·99	10·27	10·50	10·40	10·13	9·89	9·79	10·09
1877-1883	9·57	9·88	10·21	10·44	10·48	10·29	10·12	9·96	10·12
Difference from mean ...	—·55	—·24	·09	·32	·36	·17	·00	—·16	—

*October 1882—October 1883.

TABLE III.

HARMONIC CONSTANTS DERIVED FROM MEAN MONTHLY SEA-TEMPERATURES AT VARIOUS POINTS ALONG THE ROUTE FROM HULL TO HAMBURG.

Longitude.	A_0.	A_1.	e_1.	Approximate date of Minimum.	Mean Maximum.	Mean Minimum.	A_2.	e_2.
				1877.				
			° ′					° ′
1° E. ...	9·82	4·35	56 35	February 17	14·17	5·47	0·72	38 8
2° E. ...	10·09	4·62	55 52	„ 18	14·71	5·47	0·74	51 34
3° E. ...	10·34	5·03	55 52	„ 18	15·37	5·31	0·84	48 53
4° E. ...	10·61	5·42	54 51	„ 19	16·03	5·19	0·76	53 35
5° E. ...	10·67	5·74	55 44	„ 18	16·41	4·93	0·82	55 55
6° E. ...	10·55	5·95	57 29	„ 17	16·50	4·60	0·98	46 14
7° E. ...	10·35	6·01	57 51	„ 16	16·36	4·34	1·08	48 46
8° E. ...	10·33	6·56	61 31	„ 12	16·89	3·77	0·91	52 38
				1878.				
			° ′					° ′
1° E. ...	9·94	5·01	60 1	February 14	14·95	4·93	0·59	1 15
2° E. ...	10·54	5·07	55 7	„ 19	15·61	5·47	0·53	42 33
3° E. ...	10·81	5·44	57 10	„ 17	16·25	5·37	0·62	15 40
4° E. ...	11·11	5·74	56 11	„ 18	16·85	5·37	0·66	8 3
5° E. ...	11·20	5·93	56 31	„ 17	17·13	5·27	0·76	— 2 16
6° E. ...	10·92	5·74	61 5	„ 13	16·66	5·18	0·71	15 26
7° E. ...	10·95	6·38	61 37	„ 12	17·33	4·57	0·93	7 9
8° E. ...	10·52	6·70	70 38	„ 3	17·22	3·82	0·94	12 12
				1879.				
			° ′					° ′
1° E. ...	8·34	5·09	52 11	February 22	13·43	3·25	0·18	—73 0
2° E. ..	8·73	5·46	48 47	„ 25	14·19	3·27	0·16	—55 14
3° E. ...	9·13	5·93	47 20	„ 27	15·06	3·20	0·22	10 18
4° E. ...	9·27	6·43	48 29	„ 26	15·70	2·84	0·38	10 43
5° E. ...	9·20	6·83	51 25	„ 23	16·03	2·37	0·49	22 53
6° E. ...	9·05	7·31	53 51	„ 20	16·36	1·74	0·63	24 31
7° E. ...	9·07	7·68	57 49	„ 16	16·75	1·39	0·65	41 16
8° E. ...	9·02	8·93	66 5	„ 8	17·95	0·09	0·74	11 50

TABLE III—*continued.*

HARMONIC CONSTANTS DERIVED FROM MEAN MONTHLY SEA-TEMPERATURES AT VARIOUS POINTS ALONG THE ROUTE FROM HULL TO HAMBURG—*continued.*

Longitude.	A_0.	A_1.	e_1.	Approximate date of Minimum.	Mean Maximum.	Mean Minimum.	A_2.	e_2.
				1880.				
			° ′					° ′
1° E. ...	9·90	5·24	57 9	February 17	15·14	4·66	0·62	1 50
2° E. ...	10·13	5·48	54 40	„ 19	15·61	4·65	0·69	10 39
3° E. ...	10·47	5·97	53 52	„ 20	16·44	4·50	0·56	6 7
4° E. ...	10·56	6·40	54 1	„ 20	16·96	4·16	0·56	2 3
5° E. ...	10·70	6·95	55 34	„ 18	17·65	3·75	0·63	20 27
6° E. ...	10·43	7·22	57 2	„ 17	17·65	3·21	0·69	18 42
7° E. ...	10·16	7·53	59 52	„ 14	17·69	2·63	0·56	10 18
8° E. ...	9·96	8·08	69 26	„ 5	18·04	1·88	0·71	38 9
				1881.				
			° ′					° ′
1° E. ...	9·17	4·79	59 22	February 15	13·96	4·38	0·84	27 8
2° E. ...	9·27	4·91	57 13	„ 17	14·18	4·36	0·85	22 33
3° E. ...	9·73	5·34	54 55	„ 19	15·07	4·39	0·85	12 27
4° E. ...	9·95	5·87	54 17	„ 20	15·82	4·08	0·80	11 9
5° E. ...	10·0	6·38	54 39	„ 19	16·38	3·62	0·85	11 48
6° E. ...	9·82	6·65	55 55	„ 18	16·47	3·17	0·95	12 35
7° E. ...	9·56	6·87	57 50	„ 16	16·43	2·69	0·88	15 58
8° E. ...	9·47	7·38	64 43	„ 9	16·85	2·09	0·95	20 58
				1882.				
			° ′					° ′
1° E. ...	10·10	4·51	58 53	February 15	14·61	5·59	0·85	10 7
2° E. ...	10·35	4·63	56 54	„ 17	14·98	5·72	0·69	1 39
3° E. ...	10·72	4·90	56 49	„ 17	15·62	5·82	0·58	7 52
4° E. ...	11·04	5·22	59 22	„ 15	16·26	5·82	0·55	7 15
5° E. ...	11·21	5·49	62 47	„ 11	16·70	5·72	0·59	10 44
6° E. ...	11·08	5·75	66 31	„ 7	16·83	5·33	0·77	20 34
7° E. ...	10·86	6·28	69 6	„ 5	17·14	4·58	0·82	15 33
8° E. ...	10·55	7·09	74 43	January 30	17·64	3·46	0·83	19 6
				MEANS*: JANUARY 1877—SEPTEMBER 1883.				
			° ′					° ′
1° E. ...	9·57	4·76	57 13	February 17	14·33	4·81	0·50	25 36
2° E. ...	9·88	4·93	54 30	„ 19	14·81	4·95	0·49	39 13
3° E. ...	10·21	5·32	53 57	„ 20	15·53	4·89	0·50	37 12
4° E. ...	10·44	5·75	54 10	„ 20	16·19	4·69	0·51	36 35
5° E. ...	10·56	6·14	55 33	„ 18	16·70	4·42	0·59	36 5
6° E. ...	10·29	6·41	58 12	„ 16	16·70	3·88	0·69	38 31
7° E. ...	10·10	6·83	61 14	„ 13	16·93	3·27	0·81	34 28
8° E. ...	9·96	7·35	64 25	„ 10	17·31	2·61	0·76	48 45
Mean ...	10·13	5·94	57 24	„ 17	16·06	4·19	0·61	37 3

* The above Table and Table IV. have been re-calculated from the mean temperatures of the seven years, and differ somewhat from the arithmetic mean of the co-efficients given above for the separate years, owing to the summation of small differences.

TABLE IV.

HARMONIC CONSTANTS FOR MEAN SEA-TEMPERATURES ALONG THE WHOLE ROUTE, FROM HULL TO HAMBURG, 1877–1883.

—	A_0.	A_1.	e_1.	Approximate date of Minimum.	Mean Maximum.	Mean Minimum.	A_2.	e_2.
			° ′					° ′
1877 ...	10·35	5·50	56 26	February 18	15·85	4·85	0·85	40 36
1878 ...	10·75	5·37	67 47	„ 6	16·12	5·38	0·67	6 24
1879 ...	8·98	6·54	53 28	„ 21	15·52	2·44	0·36	27 40
1880 ...	10·28	6·57	58 7	„ 16	16·85	3·71	0·61	11 19
1881 ...	9·63	6·01	57 29	„ 17	15·64	3·62	0·84	88 0
1882 ...	10·74	5·45	63 0	„ 11	16·19	5·29	0·70	9 4
1883* ...	10·09	5·65	57 43	„ 16	15·74	4·44	0·69	45 35

* October 1882—October 1883.

TABLE V.

HULL TO HAMBURG. SURFACE-TEMPERATURES, 1877–1883.

Difference between the Monthly Means from Observation and the Monthly Means calculated from the Annual Sine-curve, the latter being subtracted from the former.

Longitude E. ...	1°	2°	3°	4°	5°	6°	7°	8°	Mean.
January	0·16	0·16	0·21	0·27	0·27	0·42	0·55	0·51	0·33
February	0·80	0·62	0·77	0·74	0·69	0·77	0·96	0·95	0·79
March	0·24	0·09	0·21	0·28	0·18	0·24	0·12	0·17	0·20
April	−0·51	−0·68	−0·54	−0·56	−0·67	−0·43	−0·45	−0·30	−0·50
May	−0·94	−0·66	−0·66	−0·60	−0·20	−0·76	−0·73	−0·46	−0·64
June	0·18	0·10	0·29	0·26	0·01	0·08	−0·16	−0·50	−0·13
July	−0·10	0·10	0·16	0·17	0·11	0·44	0·32	0·49	0·21
August	0·32	0·41	0·22	0·21	0·21	0·57	0·59	0·43	0·38
September	0·56	0·60	0.35	0·33	0·40	0·29	0·68	0·38	0·45
October	−0·30	−0·31	−0·24	−0·20	−0·37	−0·41	−0·49	−1·06	−0·42
November	−0·05	−0·25	−0·37	−0·44	−0·59	−0·71	−0·63	−1·08	−0·53
December	−0·51	−0·13	−0·42	−0·47	−0·40	−0·35	−0·38	−0·38	−0·39

TABLE VI.

DIFFERENCES BETWEEN MONTHLY MEAN TEMPERATURES FROM OBSERVATION AND MEANS CALCULATED FROM THE ANNUAL SINE-CURVE.

—	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1. Falmouth. Sea-temperature (1872–1885). $f(t) = 11{\cdot}7° - 3{\cdot}44 \sin(2\theta + 56°) + 0{\cdot}31 \sin(2\theta + 6°)$.												
Observed ...	8·9	8·6	8·8	9·6	11·1	13·1	14·4	15·4	15·0	13·7	11·6	9·8
Calculated ...	8·9	8·3	8·6	9·8	11·4	13·2	14·5	15·1	14·8	13·6	11·9	10·2
Difference ...	0·0	0·0	0·2	−0·2	−0·3	−0·1	−0·1	0·3	0·2	0·1	−0·3	−0·4
2. Outer Dowsing Lightship. Sea-temperature (1880–1897). $f(t) = 9{\cdot}17° - 4{\cdot}73 \sin(2\theta + 54°) + 0{\cdot}32 \sin(2\theta + 40°)$.												
Observed ...	5·3	4·9	5·0	6·2	7·9	11·4	13·1	14·0	13·7	11·8	9·3	7·3
Calculated ...	5·3	4·4	4·8	6·4	8·6	11·1	13·0	13·9	13·5	12·0	9·7	7·3
Difference ...	0·0	0·5	0·2	−0·2	−0·7	0·3	0·1	0·1	0·2	−0·2	−0·4	0·0

TABLE VI—*continued.*

Differences between Monthly Mean Temperatures from Observation and Means calculated from the annual Sine-curve—*continued.*

—		Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
3. Atlantic Ocean, S. of Newfoundland, 45° N., 55° W. Mean Sea-temperature. $f(t) = 7·44° - 6·86 \sin(\theta + 43°) + 1·44 \sin(2\theta + 4°)$.													
Observed	...	2·8	1·7	2·2	2·8	3·9	7·2	12·8	15·6	15·0	12·2	7·8	5·0
Calculated	...	2·8	0·9	0·8	2·4	5·4	9·0	12·1	14·0	14·1	12·5	9·4	5·9
Difference	...	0·0	0·8	1·4	0·4	−1·5	−1·8	0·7	1·6	0·9	−0·3	−1·6	−0·9
4. Atlantic Ocean. 40° N., 55° W. Mean Sea-temperature. $f(t) = 17·64° - 5·52 \sin(\theta + 45°) + 0·56 \sin(2\theta + 55°)$.													
Observed	...	13·9	12·2	12·8	13·9	15·0	16·3	22·2	23·9	22·8	20·6	18·3	16·7
Calculated	...	13·7	12·3	12·3	13·7	16·2	19·1	21·5	23·0	23·0	21·5	19·1	16·2
Difference	...	0·2	−0·1	0·5	0·2	−1·2	−2·8	0·7	0·9	−0·2	−0·9	−0·8	0·5
5. Atlantic Ocean, near to Azores. 40° N., 30° W. Mean Sea-temperature. $f(t) = 17·59° - 3·27 \sin(\theta + 54° 45') + 0·7 \sin(2\theta + 23° 30')$.													
Observed	...	15·0	15·0	15·0	15·6	16·7	18·3	20·6	21·7	21·1	18·9	17·2	16·1
Calculated	...	14·9	14·3	14·6	15·7	17·3	19·0	20·3	20·8	20·6	19·5	17·9	16·2
Difference	...	0·1	0·7	0·4	−0·1	−0·6	−0·7	0·3	0·9	0·5	−0·6	−0·7	−0·1
6. Atlantic Ocean. 30° N., 50° W. Mean Sea-temperature. $f(t) = 23·0° - 3·5 \sin(\theta + 48°) + 0·74 \sin(2\theta + 49°)$.													
Observed	...	20·6	20·0	20·0	20·6	21·1	23·9	26·1	27·2	26·7	23·9	23·3	22·2
Calculated	...	20·4	19·6	19·7	20·6	22·2	24·0	25·5	26·3	26·3	25·3	23·7	21·9
Difference	...	0·2	0·4	0·3	0·0	−1·1	−0·1	0·6	0·9	0·4	−1·4	−0·4	0·3
7. Falmouth. Mean Air-temperature. $f(t) = 10·98° - 5·82 \sin(\theta + 77°) + 1·21 \sin(2\theta + 60°)$.													
Observed	...	6·9	7·0	7·2	9·3	11·6	14·7	16·2	16·2	14·6	11·7	9·1	7·3
Calculated	...	5·3	5·4	7·0	9·7	12·7	15·2	16·7	16·5	15·0	12·3	9·3	6·7
Difference	...	1·6	1·6	0·2	−0·4	−1·1	−0·5	−0·5	−0·3	−0·4	−0·6	−0·2	0·6
8. Greenwich. Mean Air-temperature (1841–1890). $f(t) = 9·7° - 6·8 \sin(\theta + 83°) + 0·7 \sin(2\theta + 58°)$.													
Observed	...	3·63	4·17	5·38	8·43	11·72	15·24	16·91	16·45	13·99	10·00	6·23	4·26
Calculated	...	2·95	3·44	5·60	8·94	12·36	15·13	16·45	15·96	13·79	10·46	7·04	4·27
Difference	...	0·68	0·73	−0·22	−0·51	−0·64	0·11	0·46	0·49	0·20	−0·46	−0·81	−0·01

REPORT

ON THE

DEEP CURRENTS OF THE NORTH SEA

AS ASCERTAINED BY

EXPERIMENTS WITH DRIFT BOTTLES.

By

Captain C. H. BROWN.

CONTENTS.

(With Three Charts).

REPORT

ON THE

DEEP CURRENTS OF THE NORTH SEA

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INTRODUCTION.

The action of the restless waters of the sea in transporting the eggs and young of fishes and other floating organisms to localities other than those in which they originated, has undoubtedly an important bearing on many of the fishery problems which are gradually being elucidated. If by direct experiment we can ascertain, at various selected positions, the general movements of the water, its temperature and its salinity, the origin of the ever changing waters of the North Sea may be confidently traced.

While the trend of the surface waters of the North Sea has been ably investigated by Dr. T. Wemyss Fulton, and the relation of the movement of the surface waters to fisheries discussed by him (Fifteenth Annual Report of Scottish Fishery Board, 1896, Part iii., p. 334), no attempt has been made, at least on a comprehensive scale, to ascertain directly, by means of floats, the horizontal motion of the bottom waters.

Heretofore, the obstacle to this method of finding the direction of the bottom currents has apparently lain in the difficulty of procuring an independent float, which should remain poised a foot or two above the sea bottom, and yet be carried along with the bottom drift. It might be suggested that a weighted float could be suspended at any desired depth by means of a cord from an auxiliary surface float, having a reserve of buoyancy. The objections to this method are twofold: (1) The resultant direction taken by the lower float would be affected by the motion of other layers of water acting on the upper float and on the suspending cord, and (2) the lower float would become grounded on reaching shallow water.

A beautiful current-meter has been designed by Dr. Ekman, which, on being lowered to any desired depth and the mechanism released by means of a messenger, registers the direction and rate of flow of the current at that particular depth. The instrument is perfect, but in order to use it, the ship must be at anchor and the sea smooth; the former condition confines its practical use to comparatively shallow water, while a placid condition of the surface is seldom experienced in the North Sea.

The present experiments were conducted by a special drift bottle, the device of Mr. G. P. Bidder. This is a bottle so weighted as just to float in sea-water; a long copper wire is then attached to it by which it is caused to sink, but as soon as the wire trails upon the bottom the bottle tends to float again. Accordingly it remains floating a few inches above the sea bottom, is carried along by the bottom current, and in the course of time may be scooped up by a trawl net or found stranded on a beach.

The results of our first experiments, although covering a comparatively small area of the North Sea, have so far proved remarkably successful, and further experiments are now being made on a much larger scale.

APPARATUS AND METHODS.

The special apparatus employed during the period now under review, was simple consisting essentially of a drift bottle, similar in shape and size to an ordinary soda-water bottle, made of strong glass to resist pressure, and containing an addressed card, the reverse side being as follows :—

No.................

INTERNATIONAL FISHERY INVESTIGATIONS.

Please state **where** and **when** this card was found, and then put it in the nearest Post Office. You will be informed in reply where and when it was set adrift. Our object is to find out the Direction of the Deep Currents of the North Sea.

Locality *where found?*

Depth

Date *when found?*

Name of Sender

Address No.

The weight of the bottle was carefully adjusted by means of small shot placed securely inside of the neck, fitted with a screw stopper, made thoroughly water-tight by being dipped in pitch, and then a piece of straightened copper wire about twenty-four inches in length was attached to the neck of the bottle. Finally, the total weight of the finished bottle was carefully tested in order to insure that its specific gravity was slightly greater than that of the sea water, just sufficiently in excess to admit of its sinking slowly, neck downwards, when the slightest pressure of the tip of the copper wire referred to would prevent it from resting on the sea bottom.

The experiments were begun in June, 1906, and since then 1,012 of these submarine messengers have been put away at intervals, in the northern part of the North Sea, from the "Goldseeker," during her periodic cruises.

Twenty per cent. of these have been recovered at various times and positions, most of them at sea by means of the trawl net. Twenty bottles were found at various points on the coast of Shetland and east coast of Scotland, while thirteen were found on the coasts of Denmark, Norway and Sweden.

Guided by the positions of their recovery, we may conveniently divide the bottles, for the purposes of discussion, into three distinct groups. The most important group is composed of the bottles trawled up from the sea bottom and which we have designated "Trawled Bottles." They supply the information on which the calculations are based, and from which the bottom currents (Plate I.) have been determined.

The bottles found on our home coasts, which have traversed a track of comparatively small mileage, have been called "Stranded Bottles," as distinguished from the third group, which is composed of the bottles found on the Scandinavian coasts and which have been named "Long Distance Drifts."

We are much indebted to the captains of trawlers and to the several gentlemen who kindly forwarded the cards from the stranded bottles, for their courteous assistance and for the valued information they have supplied.

TRAWLED BOTTLES.

The set and drift from the position where each bottle was put overboard to the position where it was recovered, have been calculated from the simple formulae

$$\text{I. Tan Co} = \frac{L}{l} \text{Cos Lat.}$$

$$\text{II. Distance} = l \text{ Sec Co.}$$

Where L represents the difference of longitude,
l the difference of latitude, and
Co the direction of drift.

The direction and apparent distance drifted by each bottle were first plotted on a chart, but the lines thus obtained appeared confused ; after, however, reducing each drift to a common period of time, and again projecting on the chart, the results appeared more systematic.

Even then a few of the drifts seemed abnormal—some in direction, some in distance—but on re-examination, these were found to have been less than thirty days adrift. Considering the fact that the positions given must of necessity be approximate, and that an error in the averaged distance arising from any inaccuracy in the positions given varies in inverse ratio to the time occupied, it was decided to eliminate from the calculations all bottles having a drift of less than thirty days duration.

The North Sea was then divided into areas equal to a half degree of latitude and one degree of longitude, each area being a square of approximately thirty miles, and all the drifts through each area were tabulated. The resultant direction and distance of drift for each area were then calculated and projected; but in order to obtain a line of convenient magnitude, the resultants shown on Plate I. represent the average distance drifted by the bottles in one hundred days.

It has been assumed in the first instance, when calculating the direction and drift of each bottle, that it has drifted on the rhumb line joining the points of its submersion and recovery, but our information goes to show that this could seldom be the case. For example, bottle No. 107 was put overboard in the Moray Firth, off Kinnaird Head, and was picked up to the south of Buchanness, and must have followed a curved course to do so. The resultants of the areas are therefore tangential to curves, and it follows that by plotting the tangents conveniently close together, a very close approximation to the natural curve is obtained. Since the several resultants are found to arrange themselves in a very systematic way, the curved resultants group them together and complete the diagram.

The results are clear and important. They reveal the existence of an outstanding and clearly defined eddy, having a left handed circulation, the vortex of which is situated about midway between the Witch Ground and Bressay Shoal. It covers an area extending in latitude from the southern edge of the Long Forties to the parallel of Sumburgh Head, and from the second meridian of west longitude, eastward to the Norwegian coast.

Coming into the North Sea through the Shetland–Norway Channel, the bottom current flows southward on the east side of the Shetland Isles, and sets towards Kinnaird Head. The water of the main eddy gradually inclines more and more easterly, and, about the meridian of Greenwich, bends to the northward of east, and flows polarwise through the Norwegian Rift.

A deflection of the western periphery of the eddy takes place off the north-east shoulder of Scotland, for we find a south-westerly set towards the Cromarty Firth, while part of the waters trend southerly along the Aberdeenshire coast.

About the parallel of fifty-seven degrees latitude a divergence takes place, part of the stream setting eastward, and, as will subsequently be shown, continues across to the Skagerrak, while part branches sharply to the southward and south-west, forming a very decided set towards the Firth of Forth and the coasts lying south of it.

In this locality there is a suggestion that another eddy, similar to that just described, exists in the southern portion of the North Sea.

Stranded Bottles.

In obtaining the resultant for each area, no account has been taken of bottles found on the beach, as it must remain problematical how long they may have lain there before being found. They are, however, tabulated in Table IV., and their assumed track projected on Plate II.; for although they may be of little value in indicating the rate of drift, yet they are most valuable in giving us the direction of the current. The several places where these stranded bottles—some 20 in number—were picked up, is given with great precision, and as the position where each bottle was put overboard is clearly defined, the consequent direction of drift can be relied upon. This affords us an independent factor by which we may verify—for a few of the inshore areas at least—the value of our bottom curves; and if these independent drifts reconcile themselves in a natural and reasonable way to the curved resultants of Plate I., they supply important corroborative evidence that the deductions derived from the Trawled Bottles are practically correct.

It may, therefore, be profitable for us to refer for a moment to the individual drifts of the group, and briefly to trace the probable track along which each may have been carried, so as to see in how far this supposed direction coincides with the bottom curves.

Group I.

Bottle No. 108 was put overboard two miles east from Out Skerries, Shetland, and was found on the beach close to Sumburgh Head, having been carried a distance of some 39 miles in a direction which coincides with that of the bottom curves.

In contra-distinction to this, however—

Bottle No. 200 was put overboard 9 miles east-half-south from Noss Head, Bressay Island, and was found on Fetlar Island, having apparently drifted 30 miles almost due north, a direction which is almost opposite to that of No. 108. This is the only drift which is difficult to reconcile with the bottom curves. At a first glance one might evade the difficulty by conjecturing it to have floated on the surface, but the direction is still contrary to the known general southerly trend of the surface current.

The history of this bottle was veiled in obscurity for a period of 621 days. May it not have been carried south towards Sumburgh Head, then northward along the west coast of Shetland, round Muckle Flugga, and finally southward again to its resting place on Fetlar Island. To traverse this route it would have to attain an average speed of only something between two and three tenths of a mile per day.

We are inclined to believe that this may have been the route followed by this elusive messenger, and are encouraged to do so by the information derived from—

Bottle No. 97, the only one returned from the west coast of Shetland. This bottle was put away four miles south of Sumburgh Head, and was evidently carried round Fitfull Head towards Scalloway Bay, for it was found on Burra Isle, having drifted at an apparent average speed of ·21 miles per day in some 95 days.

This drift is particularly interesting, as it indicates the existence of a deep current setting northward along the west coast of Shetland, and offers a reasonable explanation of the manner by which bottle No. 200 managed to get north of the place where it was put away.

Group II.

Bottle No. 138 was put away 34 miles north of Kinnaird Head, whence, guided by the bottom curves, we would expect it to be carried towards Buchanness and south along the Aberdeenshire coast. This is, doubtless, what happened, for it was found on the beach close to the River Ythan, about midway between Aberdeen and Buchanness.

Bottle No. 107 was put away 11 miles north-east ½-east from Kinnaird Head, right in the assumed line of progression of the previous bottle. We would, therefore, expect it to pursue the same course, and apparently it has done so, for it was also found close to the River Ythan, about 1 mile north from No. 138.

It is of interest to note that bottle No. 138 was put overboard on the 27th May, 1907, and found 254 days later, having drifted 57 miles at an apparent daily speed of ·22 miles. Bottle No. 107 was put overboard on the 4th July, 1907, and found 123 days later, having drifted 30 miles at practically the same average speed, namely ·24 miles per day.

Bottle No. 64 was put overboard 33 miles north by east from Kinnaird Head, about 7 miles from the position where No. 138 was dispatched. We would expect this bottle to be guided by much the same influences as the preceding two, and to be set close past Buchanness and southward along the coast. We find this was the case. It, however, escaped, being drawn inshore on the Aberdeenshire coast, and continued its journey south until it was eventually stranded on the beach of St. Andrew's Bay, having drifted 117 miles in some 193 days.

Bottle No. 19 was put away two miles east from Kinnaird Head, and was found on the beach in Rattray Bay, having thus been carried southeasterly round Rattray Head.

Bottles Nos. 83 and 135 were put away on the same day, within three miles of each other, the former one mile, and the latter four miles off Kinnaird Head. Both were found about one mile to the west of Kinnaird Head, both having been carried, along with all the bottles of this group, in a direction which agrees with the bottom curves.

Group III.

Bottle No. 57 was put away in the Dornoch Firth, two miles from Tarbetness, and was found 72 days later on the beach, six miles further up the Firth.

Bottle No. 153 was put away about the middle of the Moray Firth in Lat. 57° 57′ N., Long. 2° 53′ W., when, from the bottom curves, we would expect it to be carried westward. This was the case, for it was found at Brora, having drifted 31 miles due west.

The drift of the two bottles of this group indicates a continuance of the bottom current, right into the corner of the Moray Firth.

Group IV.

Bottle No. 20 was put overboard one mile to the west of May Island, and was found on the beach 2½ miles west of North Berwick, having been carried ten miles in a southwest direction.

Bottle No. 51 was put overboard 31 miles east from Fifeness, a position from which we would expect it to be carried to the southwest. Evidently this was so, for it was found 184 days later at Alnmouth Bay, a few miles north of Coquet Island, having drifted 58 miles during the interval. This drift indicates that the bottom current may haul more to the southward and set along the Coast of England. It also suggests, in conjunction with the scanty bottom curves we have been able to obtain in this latitude, that in the southern part of the North Sea an eddy may exist having a similar circulation to the eddy which has been established in the northern part.

Bottle No. 179 was put away on the Aberdeen Bank in Lat. 57° 15′ N., Long. 0° 47′ W. This is the locality where the bottom current appears to separate, the main body of the water recurving to the east and north, while part sets to the south, hauling southwesterly into the Firth of Forth. Of these two forces, the bottle apparently came under the influence of the latter, as it was found on the beach close to Dunbar, having followed, along with the two preceding bottles, a direction in close agreement with the bottom drift.

Group V.

Bottle No. 47 was put away 35 miles east by north from Fifeness. It was found at Crail, close to Fifeness.

Bottle No. 177 was put away ten miles east half south from Fifeness. It was found on Tentsmoor Sands, a mile to the south of the entrance to the Firth of Tay. It has evidently been carried through St. Andrew's Bay, which suggests that a divergence of the bottom current takes place off Fifeness, part of the water continuing to flow to the southwest, while part flows along the north shore of Fife.

Bottle No. 165 was put away 37 miles east north east from Fifeness, and from the bottom curves we would expect it to be carried to the westward. This bottle was also found on Tentsmoor Sands, so, like the preceding one, it also had been carried through St. Andrew's Bay.

Bottle No. 123 was put away 10 miles east half south from Fifeness, the same position as No. 177, and on the same day as bottle No. 165, namely 25th July, 1907. It would in all probability be subjected to the same influences, and should likewise have been carried into St. Andrew's Bay. It was found at Johnshaven, eight miles north of Montrose. In addition to the set into St. Andrew's Bay, this drift suggests that a deep current sets northward from the Bay.

Bottle No. 48 was put away 13 miles east south-east from Fifeness, and within six miles of the position of the preceding bottle. It also escaped the set into the Firth of Forth, and was apparently carried through St. Andrew's Bay. The fact of its being found on the beach at Auchmithie, 5 miles north of Arbroath, again suggests the existence of a north-going, in-shore, deep current.

Bottle No. 154 was put away in Lat. 56° 35′ N., Long. 1° 07′ W., a position 49 miles due east from Arbroath. From our curves we would expect it to be carried by the south-west drift towards Fifeness. This bottle also escaped the set into the Firth of Forth, and was apparently carried through St. Andrew's Bay. It was found on the beach at Arbroath, which gives further evidence that a deep current sets northerly across the mouth of the Firth of Tay.

The two bottles of this group found on Tentsmoor Sands clearly show that the bottom current sets westward along the northern shore of the Fifeshire promontory, and sweeps in a northerly direction through St. Andrew's Bay. The three bottles found at different places on the coast of Forfarshire and Kincardineshire indicate the existence of a deep current setting northerly across the entrance to the Firth of Tay, its horizontal flow extending at least as far north as Johnshaven, and being sandwiched between the Scottish coast and the south-going bottom current which exists more to seaward. The observations are, however, too meagre to show whether this in-shore drift is of a permanent character, or subject to seasonal changes.

The apparent directions of drift of the several "Stranded Bottles" having freely reconciled themselves to the curves obtained from the "Trawled Bottles," give us confidence to believe in the correctness of the deductions made therefrom. They do more. They add to our information by bringing fragmentary but striking evidence of the continuance of the bottom curves through the prohibited trawling grounds on the Scottish coast.

The two drifts of Group III. show that the bottom current of the Moray Firth continues to the shores of Sutherlandshire. The stranded bottles of Group IV. show a continuation of the deep current setting southerly along the Berwickshire and Northumbrian coasts.

The three bottles of Group I. found on the coast of Shetland—it is a pity that the returns from here are not more numerous—offer a vague suggestion that a deep current having a right handed circulation, may possibly circumgyrate the Shetland Islands.

The bottles of Group V. disclose a separation of the bottom waters off Fifeness, and also reveal the existence of the north going, in-shore, drift, already referred to.

Long Distance Drifts.

It has not been considered practicable to include the information supplied by the bottles found on the coasts of Denmark, Norway and Sweden in the system of areas into which the North Sea has been arranged. The considerable mileage traversed by these bottles occupying a long period of time, added to the lack of information from any intermediate point during their passage, rendered it difficult to conjecture the possible route they may have taken ; in fact, it was at first hastily assumed that somehow or other the bottles had become underweighted and consequently floated on the surface.

Most of the bottles were found on the beach, but when two were recovered from deep water, conclusively proving that these two were yet submerged and still on their passage, it became necessary to reconsider the case of the long distance drifts.

Without being dogmatic as to whether these particular bottles have been surface or bottom drifts, it will be profitable to discuss for a moment, the possible track of the individual drifts, and so to see in how far these long distance voyagers may have followed the trend of the bottom waters as revealed by the "Trawled Bottles," and set forth in Plate III.

In the absence of positive proof to the contrary, it is to be assumed for the mileage calculations, that the bottles have followed the rhumb line between their points of origin and termination, hence the distances given are less than the bottles have actually traversed. It is also to be understood that the average distances given are further vitiated by dubiety as to how long the stranded bottles may have been lying on the beach before being found.

Group I.

Referring to Plate III., we find that Bottle No. 44 was put overboard on the 14th August, 1906, in the Moray Firth. If it escaped the set into the south-west corner of the Firth, it would probably be carried round Rattray Head, and southward towards the Aberdeen Bank. It would then either continue in a southerly direction, or be carried to the eastward by the southern periphery of the eddy which has been referred to. The latter was apparently the case, the bottle being found on the coast of Denmark, about midway between Hanstholm and the Hirtshals, having drifted a distance of 399 miles in 198 days, an average rate of 2 miles per day.

Bottles Nos. 50 and 201 were both put away on the 8th October, 1906, in proximity to No. 44, and would most likely be subjected to the same influences, and both would probably traverse a similar route. Towards the end of their journey, however, they appear to have been carried more northerly than No. 44, for they both cleared the Skaw, and drifted through the Skagerrak. No. 50 was found near Tonsberg, Norway, having covered some 420 miles during its sojourn of 164 days, an average rate of 2·56 miles per day, while No. 201 was found on the coast of Bohuslan, Sweden, having covered 404 miles in 833 days, an average of ·48 miles per day.

Bottle No. 184 was put away on the 4th July, 1907, a few miles to the north of the preceding bottles. According to our bottom curves it would first be carried to the southward, then easterly and more easterly across the Long Forties towards the Skagerrak. It was found on the coast of Norway, four miles east from Ryvingen Lighthouse, having traversed 296 miles in 446 days, an average of ·67 miles per day.

Group II.

Bottle No. 85 was put overboard on the southern edge of the Long Forties on the 21st October, 1906, and No. 186 about sixty miles due east of it on the 19th December, 1906, both bottles at the outset of their journey being on the assumed line of progression of the four bottles of Group I. We would expect them to be also carried eastward. They were eventually found on the coast of Denmark within twenty miles of each other. No. 85 was picked up on Blokhus Strand, having drifted 324 miles in 284 days, an average speed of 1·14 miles per day. No. 186 was found one mile to the east of the Hirtshals Lighthouse, having drifted 285 miles in 656 days, an average of ·43 miles per day.

Bottle No. 207 was put overboard on the 19th December, 1906, in Lat. 56° 53′ N., Long. 1° 20′ E. We would expect it to be carried either to the southward, or to the eastward towards the Skagerrak. The latter was the case, the bottle being found at the Skaw, having drifted 305 miles in 790 days, an average speed of ·39 miles per day.

Group III.

Bottle No. 162 was put away on the 20th November, 1906, about forty miles north-east from Rattray Head, and No. 192 on the 15th August, 1906, in close proximity to it. We would expect them to be at first carried slightly to the eastward of south, trending more easterly as they advanced, and after passing between the Witch Ground and the Long Forties, they would either be carried towards the Skagerrak or northward through the Norwegian Rift. The latter was what happened, No. 162 being trawled up from a depth of 70 fathoms, off the Utvaer Light, having been carried 248 miles in 511 days, an average speed of ·48 miles per day. No. 192 was picked up on the beach at Melingsvaag, Norway, a position 30 miles south of that where No. 162 was found. This bottle had drifted 210 miles in 818 days, an average speed of ·26 miles per day.

Bottle No. 195 was put overboard on the 28th July, 1906, close to the assumed line of progression of the two preceding bottles. It would in all probability follow the same track. It was found on the coast of Norway, near Vigsnaes, in four fathoms of water, having been carried some 218 miles in 849 days, an average speed of ·26 miles per day.

Bottle No. 143 was put away on the southern edge of the Aberdeen Ground on the 21st October, 1906. This is the locality where the bottom currents seem to separate. The initial direction taken by the bottle would be the resultant of various influences, but the fact of its having been found at Froien Island, Alansund, Norway, indicates that at first the set to the eastward predominated, and afterwards the bottle was carried northward through the Norwegian Rift to its ultimate resting place. This bottle drifted 346 miles in 478 days, an average speed of ·73 miles per day.

Bottle No. 205 was put overboard on the middle of the Long Forties on the 16th August, 1906. Our curves indicate that it would be carried to the north-east, towards the Norwegian Rift, thence along the coast of Norway. It was found near Kristiansund, having drifted 451 miles in 890 days, an average of ·51 miles per day.

Group IV.

The two bottles of this group are of outstanding interest owing to the fact that No. 175 was found on the verge of, and No. 60 within, the Arctic Circle.

Bottle No. 60 was put overboard off Sumburgh Head, Shetland, on 12th June, 1906, and according to our bottom curves, would be carried well to the south, possibly passing eastwards over the Long Forties, and then trending more and more northerly as it advanced towards the Norwegian Rift. It has then apparently followed a direction about parallel to the Norwegian Coast, for it was found 24 miles north-west from Hammerfest.

Unfortunately the information supplied does not make it quite clear whether this bottle was brought up from the bottom, or found on the surface. Its average rate per day is at least 2·78 miles.

Bottle No. 175 was put overboard close to the positions of the bottles of Group III., on July 23rd, 1907, and during the first part of its journey it would likely be subjected to, and has apparently obeyed, the same influences. In drifting northward through the Norwegian Rift, it has escaped being drawn coastwise until reaching Indre Kvaro, Helqiland, Norway. Again the information supplied does not define whether this bottle was brought up from deep water, found on the surface, or on the beach. But the position of its recovery, protected as it is from the open sea by many intervening rocks and islands, makes it difficult to believe that a messenger, moving involuntary along the bottom, could have escaped and passed so many obstacles.*

The average rate of this bottle was at least 2·0 miles per day.

This discussion goes to show that the several directions taken by the long distance drift bottles, reasonably accommodate themselves to the curves obtained from the bottles trawled up from the bottom.

Our information, so far, covers a comparatively small area of the North Sea, and terminates abruptly about the third meridian of east longitude, leaving a blank between this

* We now learn that this bottle was found on the beach, without its wire, and had certainly therefore floated with the surface current.

and the coasts lying to the eastward. These submarine messengers have, however, bridged this unknown region. Their silent evidence testifies to the continuity of the curves.

The curves obtained from the "Trawled Bottles" have indicated that in the vicinity of the meridian of Greenwich and the parallel of 57 degrees latitude, the bottom current sets to the east. From this point, the long distance bottles indicate that a divergence takes place, part of the waters continuing directly east, towards and through the Skagerrak, and part setting more and more to the north as it advances, forming the eastern side of the cyclonic eddy and flowing northward through the Norwegian Rift.

Velocity.

In estimating the average rate of speed of the bottom drifts, it has to be borne in mind that the rate here given is the actual rate, diminished indeterminately by the effects of unknown errors in the three factors, distance, time, and retardation due to friction.

It has been premised that the distances employed in the calculations are the measurements of rhumb lines, but we know that most of the bottles have traversed a greater distance than this, so in general the average rate of movement as here given is less than the actual rate.

Again, the bottles found on the beach must have been lying for some time, more or less, before being discovered, and this unknown lengthening of the apparent period of flotation will also tend to give—by an uncertain amount—an average rate of movement less than the actual rate.

Further, there must be a slight amount of retardation due to friction of the tip of the wire in touching the ground, as the bottle moves over the bottom, and this not being allowed for will also tend to give an average rate less than the actual rate of motion.

All the bottles will be affected in like measure by possible retardation due to friction, and for comparative purposes this factor may be neglected.

The averages of the "Long Distance Drifts" will be affected by the unknown errors just referred to, in their time and distance factors. The period of transition of the bottles trawled up at sea is correctly known, so that their apparent average speed is only diminished by an error in the remaining factor, namely the difference between the actual distance traversed and the estimated distance. This will affect the average in a relatively small degree, however. The distance traversed by the "Trawled Bottles" has been comparatively short, and even if they followed a curved course between the positions where they were put away and recovered, the length of the arc thus described would be but little in excess of the length of the chord on which our calculations are based.

We may therefore assume that the speed of the bottom current is but little in excess of that set forth in each area of Plate I.

In order to discuss the bearing which the Long Distance Drifts may have on the estimated velocities, it might be as well to refer to the four groups into which they have been arranged. Neglecting then, for the time being, the effects of unknown errors in time and distance which have undoubtedly crept into the averages, and referring to—

Group I., the bottles of which were all put overboard in the Moray Firth and found on the shores of the Skagerrak, we find that the average speed per day varies from ·48 to 2·56 miles. Curiously enough the extremes are of bottles Nos. 50 and 201, both of which were put away close to each other on the same day, and both of which drifted through the Skagerrak. The average drift of this group is 1·43 miles per day.

Group II. are a closely related combination, having been all put away near the parallel of 57 degrees latitude, all carried nearly due east and all deposited on the beach to the westward of the Skaw. The average rate for this group is ·65 miles per day.

Group III. were put away to the north-eastward of Rattray Head, with the exception of No. 143 which was put away on the Aberdeen Bank. The members of this group were found at widely different positions on the west coast of Norway. Two of the bottles Nos. 162 and 195, were brought up from 70 fathoms and 4 fathoms respectively, being still "en route," so that these two are particularly interesting for the purposes of comparison, owing to the removal from their estimated average speed of the effects of possible error in their time factor. The speed of the individual bottles of this group is surprisingly uniform, varying only from one quarter to three quarters of a mile per day. The average rate for the group is ·45 miles per day, as compared with ·37 miles, the average speed of the two interesting messengers recovered in deep water.

Group IV.—The two bottles of this group were found in a high latitude, and show an average speed much in excess of the others. The actual distance traversed by No. 60 is in all probability much greater than that which is tabulated, as may be conjectured from its trace on Plate III. It has apparently travelled some 1,150 miles, which would increase its average daily rate from 2·78 miles to 3·63 miles. The average daily velocity of No. 175 is also increased from 2 to 2·38 miles, when its probable additional mileage is taken into account.

The average speed, 2·39 miles per day, of these two arctic voyagers is in agreement with the rate of motion of the surface waters as given by Dr. Fulton, who says : "The speed of the movement is usually about two or three geographical miles a day, but may be much accelerated or retarded by the action of the wind." (Fifteenth Annual Report of Scottish Fishery Board, 1896. Part iii., p. 367.) It seems highly probable, therefore, that these two bottles have drifted on the surface.

As might be expected from a liquid body moving in frictional contact over practically level ground, the horizontal rate of motion of the bottom layer of water is comparatively slow and relatively uniform.

The "Trawled Bottles" show that the southward flow from the Shetland Islands has an apparent speed of about ·14 miles per day, the progressive motion increasing slightly as the current bends to the eastward. This acceleration is accentuated by the Long Distance Drifts, Group II., which indicate an apparent average velocity of ·65 miles per day as the waters approach the Skaw, while Group I. shows the daily speed accelerated to 1·43 miles in passing through the Skagerrak.

The cyclonic speed of the water is diminished as the vortex of the eddy is approached, near which the apparent speed is only about ·02 miles per day. In the vicinity of the parallel of 57 degrees latitude, where the waters separate and the consequent route of the bottles will for a short time be undecided, the velocity obtained thereby is seen to be considerably diminished, until the current sets south-westerly towards the Firth of Forth, when the average rate increases to ·14 miles per day.

Summary.

The results of the present experiments show that a deep current, composed of Atlantic water, enters the North Sea through the Norwegian Channel. It flows south along the east coast of Shetland, continues in this direction towards Kinnaird Head, and sets south-westerly into the Moray Firth. The main body of this advancing bottom-water gradually trends more and more to the eastward, circulates round an area of almost motionless water, and passes northward along the west coast of Norway, into the Atlantic again.

While part of the waters on the southern edge of this cyclonic current bend sharply to the south and south-westward, and set towards the Firth of Forth, part continues to flow eastward towards the Skagerrak.

The general trend along the east coast of Scotland is to the south, but a deep inshore current—possibly only periodic—flows northward from St. Andrew's Bay and penetrates as far north as Johnshaven.

The progressive motion of the bottom current is slow, varying from less than one-tenth to fully three-tenths of a mile per day. The speed increases as the water flows through the Norwegian Rift, and a considerable acceleration—possibly to about one mile per day—is noticeable towards the shores of the Skagerrak.

The number of observations obtained from the first experiments are not nearly numerous enough, nor have they extended over a sufficiently long period of time, to offer an indication as to the seasonal or periodic changes, which may possibly occur in the direction or rate of drift of the bottom currents. This should prove an interesting study when the expected returns of the new experiments come to hand, the observations of which will no doubt supply the necessary information to fill the gaps which occur in the present statistics.

Table I.—Drift-bottles Recovered by Trawlers.

Reference Number.	Position.				Depth in Fathoms.	Date.		Number of Days Adrift.	Distance (in miles) between position in 30 days.	Mean Drift (in miles) in 30 days.	Direction True.	Difference of Latitude.		Departure.	
	Cast Out.		Recovered.			Cast Out.	Re-covered.					N.	S.	E.	W.
	° ′	° ′	° ′	° ′							°				
2	58 9 N.	1 50 W.	57 52 N.	1 34 W.	48	11.6.06	11.8.06	61	19·0	9·3	S. 26 E.	—	8·36	4·08	—
4	58 12 N.	0 17 W.	58 10 N.	0 20 W.	75	28.7.06	5.9.06	39	2·75	2·1	S. 40 W.	—	1·61	—	1·35
5	57 49 N.	0 54 W.	57 43 N.	0 47 W.	58	28.7.06	12.9.06	46	7·00	4·60	S. 32 E.	—	3·90	2·44	—
6	58 11 N.	0 32 W.	58 04 N.	0 56 W.	64	28.7.06	15.9.06	49	14·5	8·9	S. 62 W.	—	4·18	—	7·86
7	56 19 N.	2 11 W.	56 15 N.	2 17 W.	23	9.8.06	17.9.06	39	5·25	4·0	S. 40 W.	—	3·10	—	2·60
10	56 20 N.	2 07 W.	56 16 N.	2 22 W.	28	10.8.06	21.9.06	42	9·50	6·8	S. 64 W.	—	2·98	—	6·11
11	58 24 N.	0 24 W.	58 02 N.	0 34 W.	65	15.8.06	24.9.06	40	23·0	17·3	S. 14 W.	—	16·79	—	4·19
13	59 22 N.	0 37 W.	59 28 N.	1 02 W.	66	7.9.06	7.10.06	30	14·0	14·0	N. 64 W.	6·10	—	—	12·60
14	59 44 N.	1 07 W.	59 43 N.	1 22 W.	51	7.9.06	11.10.06	34	7·5	6·6	S. 83 W.	—	0·80	—	6·55
15	60 00 N.	2 02 E.	60 30 N.	2 46 E.	64	27.7.06	13.10.06	78	37·0	14·2	N. 36 E.	11·49	—	8·35	—
16	57 10 N.	1 48 W.	56 58 N.	2 00 W.	—	16.8.06	21.10.06	66	13·5	6·1	S. 29 W.	—	5·34	—	2·96
17	57 11 N.	1 41 W.	56 57 N.	1 55 W.	40	16.8.06	30.10.06	75	16·0	6·4	S. 28 W.	—	5·65	—	3·00
18	59 56 N.	2 00 E.	59 43 N.	1 35 E.	61	27.7.06	30.10.06	95	18·0	5·7	S. 43 W.	—	4·24	—	3·81
21	57 22 N.	0 42 E.	58 00 N.	1 07 E.	62	16.8.06	16.11.06	92	40·0	13·0	N. 20 E.	12·20	—	4·40	—
22	60 37 N.	2 14 E.	61 06 N.	2 35 E.	109	26.7.06	14.11.06	111	31·0	8·4	N. 20 E.	7·89	—	2·87	—
23	57 40 N.	1 08 W.	57 23 N.	0 33 W.	43	21.6.06	23.11.06	155	25·5	5·0	S. 48 E.	—	3·30	3·70	—
25	57 19 N.	0 21 W.	58 10 N.	0 40 W.	65	14.8.06	30.11.06	108	52·0	14·4	N. 11 W.	14·14	—	—	2·75
26	59 11 N.	0 21 E.	59 07 N.	0 12 E.	75	20.6.06	4.12.06	167	6·0	1·1	S. 48 W.	—	0·74	—	0·82
27	57 42 N.	0 55 W.	57 12 N.	1 40 W.	40	8.9.06	8.12.06	91	39·0	12·9	S. 38 W.	—	10·17	—	7·94
28	59 34 N.	1 18 W.	59 20 N.	1 18 W.	73	12.6.06	2.12.06	173	14·5	2·5	South.	—	2·50	—	—
29	56 14 N.	2 26 W.	56 21 N.	2 23 W.	—	9.8.06	10.12.06	123	7·00	1·7	N. 14 E.	1·65	—	0·41	—
30	56 46 N.	1 13 E.	56 12 N.	1 10 E.	47	13.8.06	11.12.06	120	34·0	8·5	S. 3 W.	—	8·49	—	0·44
31	59 40 N.	1 14 W	59 33 N.	1 27 W.	65	20.11.06	18.12.06	28	9·5	10·2	S. 42 W.	—	7·58	—	6·83
32	56 39 N.	1 14 W.	56 18 N.	1 34 W.	30	20.10.06	18.12.06	59	24·0	12·2	S 27 W.	—	10·87	—	5·54
34	57 52 N.	0 52 W.	57 07 N.	1 17 W.	40	28.7.06	5.1.07	161	48·0	8·9	S. 17 W.	—	8·51	—	2·60
35	59 32 N.	0 30 E.	59 38 N.	1 39 E.	70	20.6.06	12.1.07	206	35·0	5·1	N. 80 E.	0·89	—	5·02	—
36	57 53 N.	0 52 W.	58 13 N.	0 18 E.	70	21.6.06	16.1.07	209	42·0	6·0	N. 62 E.	2·80	—	5·30	—
37	58 22 N.	0 52 E.	58 32 N.	1 01 E.	77	19.12.06	16.1.07	28	11·0	11·8	N. 24 E.	10·78	—	4·80	—
40	56 35 N.	0 8 W.	56 33 N.	0 15 W.	—	20.12.06	27.1.07	38	4·5	3·6	S. 27 W.	—	3·21	—	1·63
41	58 8 N.	1 59 W.	57 58 N.	1 42 W.	45	18.12.06	3.2.07	47	13·5	8·6	S. 42 E.	—	6·39	5·75	—
42	59 29 N.	1 20 W.	58 34 N.	1 37 W.	62	21.8.06	18.2.07	181	56·0	9·3	S. 9 W.	—	9·19	—	1·45
43	60 26 N.	0 22 W.	59 50 N.	0 40 W.	72	21.11.06	24·2.07	95	37·0	11·7	S. 14 W.	—	11·35	—	2·83
46	56 26 N.	1 00 W.	56 15 N.	2 14 W.	27	13.10.06	16.3.07	154	43·0	8·4	S. 75 W.	—	2·17	—	8·11
49	56 24 N	1 21 W.	56 13 N.	2 05 W.	25	20.12.06	8.4.07	109	27·0	7·4	S. 66 W.	—	3·01	—	6·76
52	59 19 N.	0 28 E.	59 07 N.	1 35 W.	75	25.11.06	13.4.07	139	63·0	9·5	S. 79 W.	—	1·81	—	9·33
53	56 17 N.	2 05 W.	56 27 N.	2 16 W.	—	20.12.06	19.4.07	120	12·0	3·0	N. 30 W.	2·60	—	—	1·50
54	57 59 N.	2 41 W.	57 56 N.	3 32 W.	28	7.2.07	17.4.07	69	28·0	12·2	S. 84 W.	—	1·28	—	12·13
55	58 00 N.	2 54 W.	57 48 N.	3 06 W.	38	8.10.06	19.4.07	193	13·5	2·2	S. 28 W.	—	1·94	—	1·03
56	56 21 N.	1 37 W.	56 16 N.	1 50 W.	20	20.12.06	22.4.07	123	9·0	2·1	S. 53 W.	—	1·26	—	1·68
59	57 23 N.	0 50 E.	58 26 N.	2 18 E.	54	16.8.06	27.4.07	254	78·0	9·20	N. 37 E.	7·35	—	5·54	—
61	56 32 N.	0 32 W.	55 58 N.	1 04 W.	43	13.10.06	15.5.07	214	38·5	5·40	S. 28 W.	—	4·77	—	2·54
62	57 19 N.	1 02 W.	56 16 N.	1 50 W.	26	16.8.06	5.5.07	262	68·0	7·80	S. 22 W.	—	7·23	—	2·92
63	58 38 N.	1 42 W.	58 21 N.	0 12 W.	70	8.9.06	23.5.07	257	51·0	5·95	S. 70 E.	—	2·03	5·59	—
65	57 50 N.	0 49 W.	57 33 N.	1 00 E.	53	26.11·06	31.5.07	186	60·0	9·70	S. 73 E.	—	2·84	9·28	—
66	57 56 N.	0 48 W.	58 43 N.	1 23 E.	70	28.7.06	6.6.07	313	85·0	8·14	N. 57 E.	4·44	—	6·84	—
67	56 52 N.	1 06 W.	57 10 N.	1 19 W.	47	5.4.07	5.6.07	30	19·0	19·0	N. 22 W.	17·60	—	—	7·10
68	56 24 N.	1 21 W.	56 21 N.	1 33 W.	27	5.4.07	26.5.07	51	8·0	4·7	S. 66 W.	—	1·91	—	4·29
69	57 50 N.	0 54 W.	58 00 N.	0 14 E.	75	20.6.06	7.6.07	362	38·0	3·20	N. 74 E.	0·88	—	3·08	—
70	56 17 N.	2 03 W.	56 14 N.	1 48 W.	23	5.4.07	10.6.07	66	66·0	4·10	S. 70 E.	—	1·40	3·85	—
71	56 23 N.	1 16 W.	56 38 N.	1 14 W.	40	5.2.07	13.6.07	128	15·0	3·50	N. 4 W.	3·49	—	—	0·24
72	56 22 N.	1 37 W.	56 11 N.	2 07 W.	30	10.8.06	21.6.07	315	20·0	1·90	S. 57 W.	—	1·03	—	1·59
73	56 24 N.	1 21 W.	56 12 N.	2 20 W.	27	5.2.07	21.6.07	136	35·0	7·70	S. 70 W.	—	2·63	—	7·24
74	56 22 N.	1 32 W.	56 14 N.	2 13 W.	22	5.2.07	24.6.07	139	24·0	5·20	S. 71 W.	—	1·69	—	4·92
75	56 25 N.	1 07 W.	56 18 N.	1 32 W.	30	5.2.07	1.7.06	146	16·0	3·30	S. 63 W.	—	1·50	—	2·94
76	56 21 N.	1 34 W.	56 14 N.	2 13 W.	22	5.4.07	3.7.07	89	23·0	7·75	S. 72 W.	—	2·41	—	7·37
77	58 11 N.	1 31 W.	57 48 N.	1 43 W.	60	7.2.07	6.7.07	149	24·0	4·8	S. 16 W.	—	4·61	—	1·32
78	56 24 N.	1 21 W.	55 53 N.	1 32	40	10.8.06	23.6.07	317	31·5	3·0	S. 12 W.	—	2·90	—	0·60
79	58 17 N.	1 56 W.	58 0 N.	0 9 W.	65	20.6.06	21.7.07	396	59·0	4·5	S. 73 E.	—	1·32	4·30	—
80	59 23 N.	1 35 W.	59 25 N.	1 17 W.	57	10.5.07	27.7.07	78	9·0	3·5	N. 77 E.	0·79	—	3·41	—
81	58 22 N.	1 55 W.	58 17 N.	0 14 W.	70	25.2.07	27.7.07	152	54·0	10·7	S. 84 E.	—	1·12	10·64	—
82	59 10 N.	1 27 W.	58 04 N.	0 44 W.	52	12.6.06	29.7.07	412	70·0	5·1	S. 19 E.	—	4·82	1·66	—
86	56 29 N.	0 37 W	56 33 N.	1 43 W.	26	10.4.07	5.8.07	117	37·0	9·5	N. 84 W.	0·99	—	—	9·45
87	56 31 N.	0 24 N.	56 38 N.	0 53 W.	39	10.4.07	9.8.07	121	20·0	5·0	N. 70 W.	1·70	—	4·70	—
88	58 9 N.	1 50 W.	57 37 N.	1 33 W.	45	9.5.07	23.8.07	106	33·0	9·3	S. 16 E.	—	8·94	2·56	—
89	59 37 N.	1 23 W.	59 33 N	1 05 W.	68	4.7.07	28.8.07	55	9·0	5·0	S. 84 E.	—	0·50	5·00	—
90	57 42 N.	0 57 W.	57 16 N.	0 20 W.	42	26.11.06	30.8.07	277	33·0	3·6	S. 38 E.	—	2·84	2·22	—
91	56 36 N.	0 06 E	56 28 N.	0 37 W.	40	6.2.07	10.9.07	216	25·0	3·5	S. 72 W.	—	1·08	—	3·33
92	56 28 N.	0 53 W.	56 02 N.	1 53 W.	30	5.2.07	13.9.07	220	42·5	5·8	S 52 W.	—	3·57	4·57	—
93	58 45 N.	1 42 W.	57 32 N.	1 30 W.	54	2.2.07	26.9.07	226	73·0	9·7	S. 5 E.	—	9·68	0·68	—
94	58 43 N.	1 39 W.	58 42 N.	0 35 W.	67	27.5.07	2.10.07	128	33·0	7·7	S. 89 E.	—	0·13	7·70	—
95	57 26 N.	0 47 W.	51 19 N.	1 14 W.	33	14.8.06	2.10.07	414	69·0	5·0	S. 13 W.	—	4·90	—	1·10
96	56 28 N.	0 53 W.	56 01 N.	1 35 W.	—	20.10.06	5.10.07	350	36·0	3·1	S. 41 W.	—	2·34	—	2·03
98	59 37 N.	0 12 E.	59 10 N.	0 16 W.	77	21.11.06	4.10.07	317	30·0	2·8	S. 27 W.	—	2·49	—	1·27
99	58 9 N.	1 50 W.	57 25 N.	0 24 E.	43	19.11.06	9.10.07	324	84·0	7·8	S. 58 E.	—	4·13	6·61	—
100	59 18 N.	1 24 W	58 48 N.	0 28 W.	64	12.6 06	10.10.07	519	42·0	2·6	S. 44 E.	—	1·87	1·81	—
101	56 59 N.	1 09 W.	57 07 N.	1 37 W.	46	5.4.07	10.10.07	188	17·0	2·7	N. 62 W.	1·27	—	—	2·38
102	57 56 N.	0 48 W.	58 04 N.	1 04 W.	63	2.9.07	14.10.07	42	11·5	8·2	N. 48 W.	5·49	—	—	6·09
103	59 47 N.	0 21 W.	59 24 N.	0 44 W.	74	24.2.07	27.10.07	245	26·0	3·2	S. 27 W.	—	2·85	—	1·45
104	56 37 N.	0 09 E.	56 12 N.	0 20 W.	44	13.8.06	27.10.07	440	30·0	2·0	S. 33 W.	—	1·70	—	1·10
105	56 35 N.	0 10 W.	56 12 N.	1 05 W.	36	24.7.07	25.10.07	93	38·5	12·4	S. 53 W.	—	7·46	—	9·90
106	59 36 N.	0 41 W.	59 32 N.	0 50 W.	70	13.2.07	26.10.07	255	6·0	0·7	S. 49 W.	—	0·46	—	0·53

TABLE I.—*continued.*

Reference Number.	Position. Cast Out.		Position. Recovered.		Depth in Fathoms.	Date. Cast Out.	Date. Re-covered.	Number of Days Adrift.	Distance in (miles) between position in 30 days.	Mean Drift (in miles) in 30 days.	Direction True.	Difference of Latitude. N.	Difference of Latitude. S	Departure. E.	Departure. W.
	° ′	° ′	° ′	° ′							°				
109	60 06 N.	0 27 W.	59 38 N.	0 11 E.	66	1.9.07	6.11.07	66	34·0	15·5	S. 34 E.	—	12·85	8·67	—
110	56 21 N.	1 52 W.	56 09 N.	2 13 W.	28	10.8.06	18.11.07	465	17·0	1·1	S. 44 W.	—	0·79	—	0·76
111	61 30 N.	3 03 E.	60 22 N.	0 15 E.	85	20.5.07	20.11.07	184	10·8	17·6	S. 51 W.	—	11·1	—	13·7
112	58 02 N.	2 38 W.	57 49 N.	2 44 W.	39	8.10.06	30.10.07	387	13·5	1·1	S. 14 W.	—	1·07	—	0·27
113	57 45 N.	1 00 W.	56 45 N.	0 23 E.	90	23.7.06	24.11.07	484	75·0	4·6	S. 37 E.	—	3·67	2·77	—
114	57 07 N.	1 16 W.	57 09 N.	1 36 W.	35	5.4.07	28.11.07	237	11·0	1·4	N. 79 W.	0·27	—	—	1·37
115	59 33 N.	1 07 W.	59 27 N.	1 06 W.	64	3.2.07	2.12 07	292	11·0	1·1	S. 2 E.	—	1·10	0·04	—
116	60 06 N.	0 37 W.	59 47 N	0 48 W.	65	1.9.07	7.12.07	97	20·0	6·2	S. 16 W.	—	6·0	—	1·7
117	56 46 N	1 03 E.	57 27 N.	0 42 E.	46	20.12.06	13.12.07	358	42·0	3·5	N. 16 W.	3·36	—	—	0·96
118	58 20 N.	0 43 W.	58 32 N.	0 47 W.	70	9.4.07	22.12.07	257	12·0	1·4	N. 10 W.	1·38	—	—	0·24
119	58 32 N.	1 00 W.	58 24 N.	0 40 W.	68	2.9.07	20.12.07	109	13·0	3·6	S. 53 E.	—	2·17	2·88	—
120	58 20 N.	3 02 W.	57 47 N.	3 10 W.	50	15.9.06	20.12.07	461	33·0	2·1	S. 7 W.	—	2·08	—	0·26
121	57 57 N.	0 48 W.	58 01 N.	0 10 W.	75	20.6.06	22.12.07	550	21·0	1·1	N. 79 E.	0·21	—	1·08	—
122	57 24 N.	1 07 E.	58 24 N.	1 26 E.	67	12.10.06	21.12.07	435	61·0	4·20	N. 10 E.	4·14	—	0·73	—
124	58 15 N.	0 37 W.	57 50 N.	0 32 W.	63	2.9.07	28 12.07	117	25·0	6·40	S. 6 E.	—	6·36	0·67	—
125	56 28 N.	0 53 W.	56 22 N.	1 32 W.	32	24.7.07	30.12.07	159	23·0	4·30	S. 75 W.	—	1·11	—	4·15
126	58 36 N.	1 46 W.	57 45 N.	1 00 W.	63	12.2.07	28.12.07	329	57·0	5·20	S. 26 E.	—	4·67	2·28	—
127	58 30 N.	0 25 E.	58 35 N.	0 05 E.	79	23.7.07	31.12.07	161	12·0	2·20	N. 65 W.	0·93	—	—	1·99
128	58 47 N.	1 35 W.	57 57 N.	0 15 W.	62	25.2.07	2.1.08	311	65·0	6·20	S. 40 E.	—	4·75	3·99	—
129	59 34 N.	1 13 W.	59 20 N.	1 20 W	48	10.5.07	1.1.08	236	14·0	1·78	S. 4 W.	—	1·77	—	0·12
130	58 38 N.	1 42 W.	57 56 N.	0 53 W.	74	25.2.07	13.1.08	322	49·5	4·34	S. 32 E.	—	3·65	2·28	—
131	58 33 N.	1 47 W.	58 24 N.	0 23 W.	70	26.11.06	17.1.08	417	45·0	3·2	S. 79 E.	—	0·61	3·14	—
132	57 24 N.	1 07 E.	58 10 N.	3 10 E	77	6.2.07	23.12.07	320	80·0	7·5	N. 55 E.	4·30	—	6·14	—
133	58 27 N.	1 28 N.	58 10 N.	0 43 E.	78	9.4.07	21.1.08	287	29·0	3·0	S. 55 W.	—	1·70	—	2·50
134	58 08 N.	0 25 W.	58 04 N.	1 08 W.	63	2.9.07	24.1.08	144	18·0	3·70	S. 77 W.	—	0·83	—	3·61
135	57 45 N.	2 01 W.	57 41 N.	1 58 W.	—	16.7.07	30.1.08	198	4·5	0·70	S. 21 E.	—	0·65	0·25	—
136	58 34 N.	0 47 E.	58 10 N.	0 36 E.	82	9.4.07	25.1.08	291	24·0	2·47	S. 14 W.	—	2·43	—	0·60
137	59 26 N.	1 20 W.	58 45 N.	1 20 W.	60	6.8.07	4.2.08	182	41·0	6·75	South	—	6·75	—	—
139	58 47 N.	1 35 W.	58 40 N.	0 17 E.	—	8.9.06	4.1.08	438	59·0	4·04	S. 83 E.	—	0·50	4·00	—
140	58 14 N.	2 34 W.	57 47 N.	3 08 W.	42	16.7.07	3.2.08	202	33·0	4·90	S. 34 W.	—	4·06	—	2·74
141	59 22 N.	1 22 W.	58 35 N.	1 30 W.	65	10.5.07	21.1.08	256	47·0	5·5	S. 5 W.	—	5·48	—	0·48
142	58 08 N.	2 00 W.	58 05 N.	2 07 W.	38	8.4.07	13.2.08	311	5·0	0·5	S. 51 W.	—	0·31	—	0·39
144	59 21 N.	1 22 W.	59 00 N.	1 35 W.	62	6.8.07	21.2.08	199	22·0	11·1	S. 17 W.	—	10·61	—	3·25
145	59 30 N.	0 28 W.	59 37 N.	0 40 W.	73	24.2.07	26.2.08	367	10·0	0·82	N. 41 W.	0·60	—	—	0·50
146	59 25 N.	0 36 E.	59 55 N.	0 25 W.	74	5.9.06	14.2.08	527	43·0	2·45	N. 45 W.	1·73	—	—	1·73
147	58 34 N.	0 47 E.	58 32 N.	1 40 E.	63	15.8.06	14.2.08	548	28·0	1·53	S. 86 E.	—	0·10	1·50	—
148	59 03 N.	1 34 W.	58 39 N.	1 36 W.	60	10.5.07	4.3.08	299	24·0	2·41	S. 2 W.	—	2·40	—	0·08
149	58 17 N.	1 03 W.	57 05 N.	0 25 W.	62	8.4.07	14.2.08	312	33·0	3·17	S. 38 E.	—	2·44	1·91	—
150	59 13 N.	1 24 W.	58 28 N.	1 27 W.	62	12.6.06	9.3.08	636	45·0	2·12	S. 2 W.	—	2·10	—	0·07
151	58 07 N.	0 37 W.	58 10 N.	1 05 W.	62	2.9.07	5.3.08	185	15·0	2·43	N. 79 W.	0·46	—	—	2·36
152	59 34 N.	0 52 W.	58 35 N.	0 52 W.	67	10.5.07	11.3.08	306	59·0	5·78	South	—	5·78	—	—
155	56 45 N.	1 23 W.	56 15 N.	2 15 W.	25	21.10.06	20.3.08	516	42·0	2·44	S. 44 W.	—	1·75	—	1·69
156	57 24 N.	1 06 E.	57 05 N.	3 36 E.	45	16.8.06	21.3.08	583	84·0	4·32	S. 77 E.	—	0·97	4·19	—
157	58 09 N.	1 50 W.	58 00 N.	2 08 W.	45	4.7.07	1.4.08	272	13·0	1·43	S. 46 W.	—	1·01	—	0·97
159	56 04 N.	1 12 E.	58 20 N.	2 00 E.	60	6.2.07	24.3.08	412	97·0	7·06	N. 15 E.	6·76	—	1·81	—
160	56 24 N.	1 21 W.	56 08 N.	2 18 W.	—	24.7.07	9.4.08	260	36·0	4·15	S. 63 W.	—	1·86	—	3·65
161	60 04 N.	0 33 E.	59 55 N.	0 11 E.	65	1.9.07	16.4.08	228	14·0	1·84	S. 51 W.	—	1·15	—	1·43
163	59 33 N.	1 35 W.	58 30 N.	1 37 W.	59	4.7.07	22.4.08	293	63·0	6·45	S. 1 W.	—	6·45	—	0·00
164	59 26 N.	1 21 W.	58 35 N.	1 20 W.	57	10.5.07	24.4.08	350	51·0	4·37	S. 1 E.	—	4·40	0·08	—
167	58 43 N.	1 41 W.	57 50 N.	1 00 W.	75	2.9.07	10.5.08	251	57·0	6·80	S. 23 E.	—	6·26	2·66	—
168	56 34 N.	0 16 W.	56 22 N.	0 48 W.	40	5.2.07	18.5.08	468	22·0	1·41	S. 56 W.	—	0·79	—	1·17
169	58 06 N.	0 37 W.	58 18 N.	1 23 E.	75	8.9.06	17.5.08	617	65·0	3·16	N. 79 E.	0·59	—	3·40	—
170	58 41 N.	1 40 W.	58 29 N.	0 04 W.	77	26.11.06	24.6.08	576	52·0	2·71	S. 77 E.	—	0·60	2·60	—
171	56 43 N.	0 45 E.	56 32 N.	0 42 W.	40	23.7.07	3.7.08	345	51·0	4·43	S. 77 W.	—	1·00	—	4·29
172	57 08 N.	0 16 E.	57 02 N.	0 15 W.	45	14.8.06	4.7.08	690	18·0	0·78	S. 71 W.	—	1·25	—	0·74
173	57 19 N.	0 00	56 41 N.	0 11 W.	42	16.8.06	10.7.08	693	38·5	1·69	S. 9 W.	—	1·68	—	0·27
174	56 26 N.	1 27 W.	56 05 N.	2 04 W.	28	10.8.06	7.7.08	696	30·0	1·29	S. 45 W.	—	0·91	—	0·91
176	56 44 N.	1 02 W.	56 48 N.	1 56 W.	30	5.4.07	10.7.08	461	30·5	1·98	N. 82 W.	0·27	—	—	1·96
178	56 40 N.	0 24 E.	56 35 N.	0 10 W.	41	10.4.07	18.7.08	464	20·0	1·29	S. 75 W.	—	0·33	—	1·24
185	56 49 N	1 20 E.	56 53 N.	1 45 E.	53	13.10.06	27.8.06	685	14·0	0·61	N. 74 E.	0·58	—	0·17	—
187	56 34 N.	0 12 W.	56 10 N.	0 18 W.	42	13.8.06	10.10.08	787	24·0	0·91	S. 8 W.	—	0·90	—	0·13
188	56 26 N.	1 06 W.	56 15 N.	1 30 W.	35	5.4.07	19.10.08	562	17·0	0·91	S. 50 W.	—	0·58	—	0·69
189	57 12 N.	0 05 E.	56 29 N.	1 19 W.	35	14.8.06	16.10.08	793	63·0	2·38	S. 47 W.	—	1·62	—	1·74
190	60 04 N.	0 33 E.	59 27 N.	1 08 W.	67	5.9.06	26.10.08	781	62·0	2·38	S. 54 W.	—	1·40	—	1·92
193	59 39 N.	0 35 E.	59 52 N.	0 35 E.	71	1.9.07	25.10.08	419	13·0	0·93	N.	0·93	—	—	—
194	58 32 N.	0 23 E.	59 03 N.	0 35 E.	82	27.7.06	30.11.08	856	31·0	1·09	N. 7 E.	1·08	—	0·13	—
196	58 45 N.	1 42 W.	57 10 N.	0 51 E.	51	21.8.06	5.12.08	836	125·0	4·49	S. 40 E.	—	3·45	2·89	—
197	58 13 N.	1 22 W.	58 10 N.	1 20 E.	63	15.8.06	11.12.08	849	86·0	3·03	S. 88 E.	—	0·10	3·00	—
199	57 54 N.	3 31 W.	57 56 N.	3 32 W.	27	22.7.07	16.1.09	543	2·0	0·10	N. 14 W.	0·10	—	—	0·02
202	58 38 N.	0 37 E.	58 55 N.	1 23 E.	75	27.7.06	26.1.09	914	31·0	1·02	N. 51 E.	0·64	—	0·79	—
203	58 36 N.	1 46 W.	58 23 N.	1 25 W.	65	12.6.06	29.1.09	962	17·0	0·53	S. 40 E.	—	0·41	0·34	—
204	58 00 N.	2 54 W.	57 56 N.	3 00 W.	40	8.4.07	23.1.09	655	5·0	0·23	S. 38 W.	—	0·18	—	0·14

TABLE II.—Trawled Drift-bottles. Summary of results.

Area.	Nos. of bottles whose tracks lie through the said area.	Resultant	
		Direction.	Mean Drift (in miles) per 100 days.
		°	
16	111	S. 51 W.	58·6
17	111	S. 51 W.	58·6
24	111	S. 51 W.	58·6
25	22	N. 20 E.	28·0
31	43, 109, 116	S. 8 E.	33·3
32	111, 161, 190	S. 52 W.	24·3
34	15	N. 36 E.	47·3
39	14, 28, 31, 89, 115, 129, 163	S. 22 W.	10·4
40	43, 103, 106, 116, 145, 146, 152, 190	S. 22 W.	11·26
41	35, 98, 109, 161, 190, 193	S. [illegible]0 E.	10·30
42	18, 35	S. 20 E.	5·80
48	13, 28, 42, 52, 80, 82, 100, 115, 129, 137, 141, 144, 148, 150, 163, 164, 190.	S. 22 W.	11·7
49	13, 52, 98, 103, 152	S. 74 W.	17·0
50	26, 52, 146, 194	N. 89 W.	9·7
57	42, 63, 82, 93, 94, 126, 128, 130, 131, 137, 139, 141, 148, 150, 163, 164, 167, 170, 196, 203.	S. 26 E.	11·5
58	94, 100, 118, 119, 139, 152, 170	S. 63 E.	10·0
59	127, 136, 139, 147, 194, 202	S. 86 E.	2·1
60	66, 147, 202	N. 66 E.	11·0
64	120	S. 7 W.	7·0
65	112, 140, 142, 157	S. 35 W.	6·3
66	2, 41, 77, 79, 81, 82, 88, 93, 99, 126, 130, 131, 134, 149, 150, 151, 157, 167, 196, 197, 203.	S. 32 E.	14·0
67	4, 6, 11, 63, 79, 81, 82, 118, 119, 124, 128, 131, 134, 151, 169, 196, 197.	S. 26 E.	10·3
68	36, 37, 66, 133, 136, 169, 197...	S. 54 E.	12·3
69	59, 122, 133, 159, 169, 197	N. 34 E.	11·3
70	59	N. 37 E.	30·7
74	54, 55, 120, 140, 199	S. 62 W.	12·1
75	54, 55, 112, 135, 140, 204	S. 60 W.	10·3
76	2, 23, 77, 88, 93, 126, 135, 149	S. 18 E.	18·7
77	5, 27, 34, 36, 65, 66, 69, 90, 99, 113, 121, 124, 128, 130, 196	S. 40 E.	13·6
78	21, 65, 69	N. 58 E.	21·7
79	59, 122, 132, 159	N. 32 E.	22·0
80	132	N. 55 E.	25·0
81	132	N. 55 E.	25·0
86	16, 17, 27, 34, 62, 114	S. 28 W.	23·3
87	23, 25, 90, 95, 113, 172, 173	S. 57 E.	2·2
88	21, 59, 117, 172, 189, 196	S. 28 E.	11·0
89	122, 132, 156, 159	S. 42 E.	16·0
97	30, 32, 62, 67, 71, 101, 155, 176	S. 76 W.	9·5
98	40, 61, 87, 91, 95, 102, 168, 171, 173, 178, 187, 189	S. 65 W.	8·6
99	91, 104, 113, 171, 178...	S. 43 W.	7·07
100	30, 117, 159, 185	N. 14 E.	1·80
107	7, 10, 29, 46, 53, 70, 73, 74, 105, 110, 155, 160, 174 ...	S. 63 W.	12·30
108	32, 46, 49, 56, 62, 68, 71, 72, 73, 74, 75, 76, 78, 86, 92, 95, 104, 110, 125, 155, 160, 174, 188, 189.	S. 58 W.	13·60
109	61, 86, 92, [illegible]6, 104, 125, 168, 187	S. 61 W.	12·10
111	30	S. 3 W.	28·3

TABLE III.—Drifts of less than Thirty Days Duration.

Reference No. of Bottle.	Position. Where Put Away. Lat.	Position. Where Put Away. Long.	Position. Where Recovered. Lat.	Position. Where Recovered. Long.	Depth of Water.	Date. When Put Away.	Date. When Recovered.	Number of Days Adrift.	Distance between Positions.	Average Drift in Thirty Days.	Direction True.
	° ′	° ′	° ′	° ′	Fms.						
1	58 42 N.	0 48 W.	58 30 N.	0 20 W.	73	20.6.06	14.7.06	24	19	23·8	S. 51 E.
3	56 21 N.	1 42 W.	56 25 N.	1 07 W.	37	10.8.06	21.8.06	11	20	54·6	N. 77 E.
8	59 36 N.	0 57 W.	59 30 N.	1 02 W.	62	7.9.06	17.9.06	10	6·5	19·5	S. 22 W.
9	57 27 N.	1 19 W.	57 20 N.	1 33 W.	43	8.9.06	18.9.06	10	10·5	31·5	S. 43 W.
12	57 30 N.	1 12 W.	57 22 N.	1 40 W.	39	8.9.06	2.10.06	24	17	21·3	S. 63 W.
24	59 33 N.	0 41 W.	59 27 N.	0 59 W.	72	20.11.06	24.11.06	4	11	82·5	S. 54 W.
33	58 57 N.	0 08 E.	58 40 N.	1 10 E.	74	25.11.06	22.12.06	27	36	40·0	S. 63 E.
38	58 09 N.	1 50 W.	57 59 N.	1 48 W.	45	27.1.07	5.2.07	9	10	33·3	S. 5 E.
39	58 08 N.	2 00 W.	58 6 N.	2 08 W.	40	7.2.07	14.2.07	7	5	21·4	S. 70 W.
45	57 30 N.	1 12 W.	57 41 N.	1 16 W.	51	25.2.07	9.3.07	12	11	27·5	N. 14 W.
58	57 04 N.	1 15 E.	57 24 N.	0 52 E.	50	10.4.07	23.4.07	14	23	49·3	N. 31 W.
67*a*	57 40 N.	1 06 W.	57 42 N.	1 33 W.	46	27.5.07	29.5.07	2	15	—	N. 82 W.
84	58 17 N.	1 03 W.	58 08 N.	1 04 W.	60	23.7.07	27.7.07	4	9	67·5	S. 5 W.

TABLE IV.—Bottles Stranded on Scottish Coast.

Reference No. of Bottle.	Position. Where Put Away.	Position. Where Recovered.	Date. When Put Away.	Date. When Recovered.	Number of days.	Distance between Positions.	Direction True.
	GROUP I.						°
108	2 miles East from Out Skerries.	Near Sumburgh Head, Shetland.	22.8.06	2.11.07	437	39	S. 27 W.
200	9 miles E. ½ S. from Noss Head, Bressay Island.	Tresta Voe, Tetlar, Shetland.	10.5.07	21.1.09	621	30	N. 3 W.
97	4 miles South from Sumburgh Head.	Hamnavoe, Bussa Isle, Shetland.	4.7.07	7.10.07	95	20	N. 10 W.
	GROUP II.						
138	34 miles North from Kinnaird Head.	1 mile South of the River Ythan, Aberdeenshire.	27.5.07	5.2.08	254	57	S. 1 E.
107	11 miles N.E. ½ E. from Kinnaird Head.	½ mile North of the River Ythan, Aberdeenshire.	4.7.07	4.11.07	123	30	S. 16 W.
64	33 miles N. by E. from Kinnaird Head.	St. Andrew's Bay ...	20.11.06	1.6.07	193	117	S. 15 W.
19	2 miles East from Kinnaird Head.	Between Rattray Head and Scotston Head.	15.9.06	4.11.06	50	7	Southerly
83	1 mile off Kinnaird Head	Broadsea Shore, Fraserburgh.	16.7.07	24.7.07	8	2	South.
135	4 miles North from Kinnaird Head.	½ mile West of Kinnaird Head.	16.7.07	30.1.08	198	4	S. 21 W.
	GROUP III.						
57	2 miles from Tarbetness, Dornoch Firth.	1 mile from Ardmore Point, Dornoch Firth.	8.2.07	21.4.07	72	6	Westerly
153	Middle of Moray Firth, Lat. 57° 57′ N. Long. 2° 53′ W.	Brora, Sutherlandshire	7.2.07	12.3.08	399	31	N. 82 W.
	GROUP IV.						
20	1 mile West of May Island	2½ miles West of North Berwick Harbour.	9.8.06	8.11.06	91	10	S. 39 W.
51	31 miles East from Fifeness.	Foxton Burn, Alumouth Bay.	13.10.06	15.4.07	184	58	S. 3 E.
179	Aberdeen Bank. Lat. 57° 15′ N. Long. 0° 47′ W.	6 miles South from Dunbar.	16.8.06	19.7.08	703	95	S. 34 W.

TABLE IV.—*continued.*

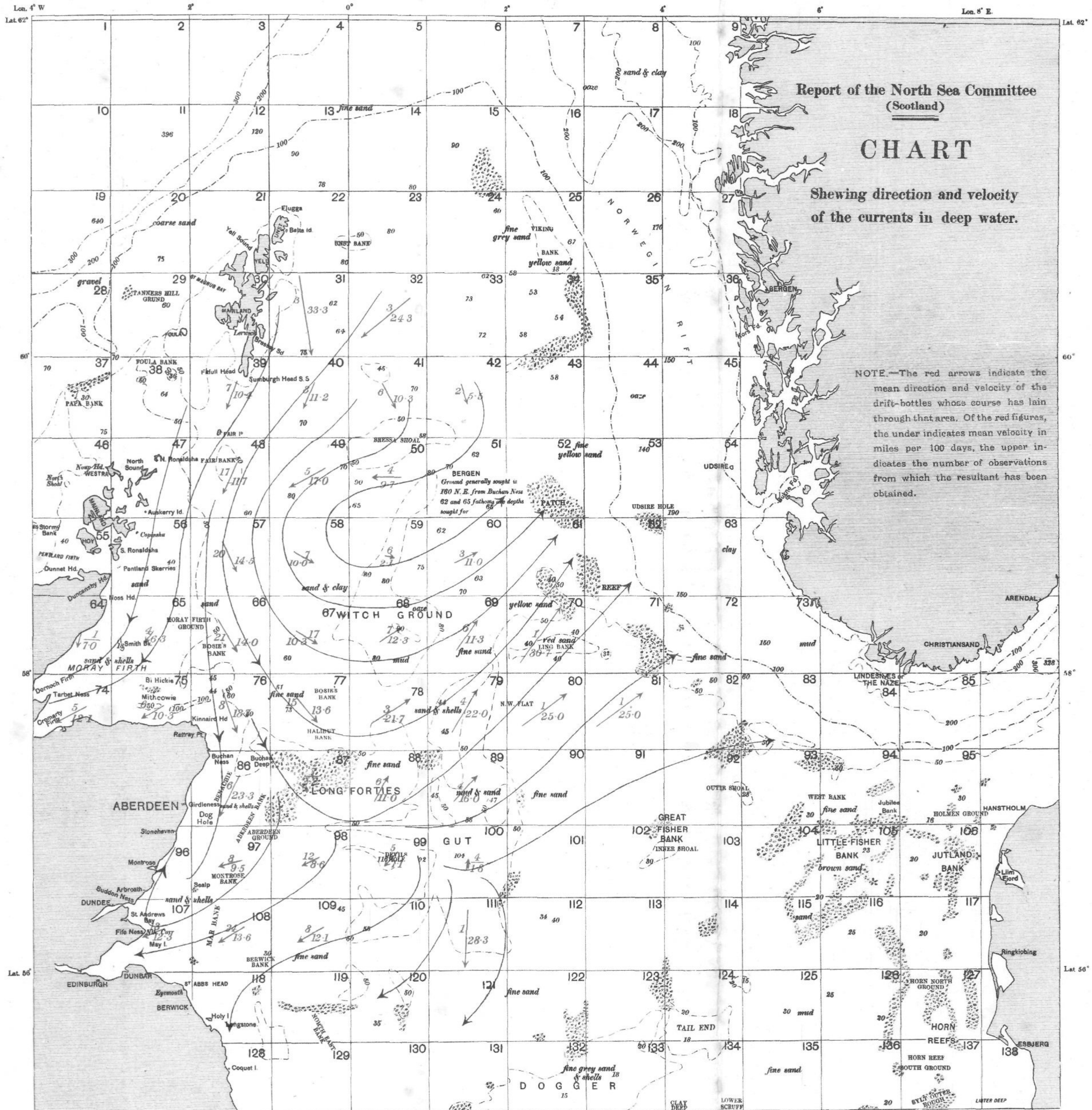
Reference No. of Bottle.	Position. Where Put Away.	Position. Where Recovered.	Date. When Put Away.	Date. When Recovered.	Number of Days.	Distance between Positions.	Direction True.
	GROUP V.						
47	35 miles E. by N. from Fifeness.	Crail, Fifeshire	10.8.06	6.4.07	239	40	S. 80° W.
177	10 miles E. ½ S. from Fifeness.	Tentsmoor Sands, St. Andrew's Bay.	9.8.06	18.7.08	709	18	N. 55 W.
165	37 miles E.N.E. from Fifeness.	Tentsmoor Sands, St. Andrew's Bay.	25.7.07	4.5.08	284	42	S. 87 W.
123	10 miles E. ½ S. from Fifeness.	Johnshaven, Kincardineshire.	25.7.07	28.12.07	156	42	N. 4 E.
48	13 miles E.S.E. from Fifeness.	Auchmithie, Forfarshire	13.10.06	6.4.07	175	25	N. 25 W.
154	49 miles East from Arbroath. Lat. 56° 35′ N. Long. 1° 07′ W.	Arbroath	26.7.07	17.3.08	235	48	S. 88 W.

TABLE V.—Long Distance Drifts.

Reference Number of Bottle.	Position. Where Put Away.	Position. Where Recovered.	Depth of Water.	Date. When Put Away.	Date. When Recovered.	Number of Days.	Distance between Positions.	Average Rate per day.
	GROUP I.							
44	58° 02′ N.; 2° 43′ W.	57° 20′ N.; 9° 35′ E. About midway between Hanstholm and Hirtshals, Denmark.	—	14.8.06	28.2.07	198	399	2·0
50	58 01 N.; 2 45 W.	59 13 N.; 10 30 E. West Coast of Tjonco, Tonsberg, Norway.	On the beach.	8.10.06	21.3.07	164	420	2·56
201	58 08 N.; 2 00 W.	58 16 N.; 11 25 E. Gårö–Bohuslan, Sweden.	On the beach.	8.10.06	18.1.09	833	404	0·48
184	58 32 N.; 1 42 W.	58 00 N.; 7 38 E. 4 miles east from Ryvingen Lighthouse, Norway.	On the beach.	4.7.07	23.9.08	446	296	0·67
					Average rate per day =			1·43
	GROUP II.							
85	57 09 N.; 0 38 W	57 19 N.; 9 37 E. Blokhüs, Denmark.	—	21.10.06	1.8.07	284	324	1·14
186	57 01 N.; 1 14 E.	57 36 N.; 10 00 E. Tannis Bay, 1 mile east from Hirtshals Lighthouse.	—	19.12.06	5.10.08	656	285	0·43
207	56 53 N.; 1 20 E.	57 45 N.; 10 34 E. On the north side of Skagen–Denmark.	On the beach.	19.12.06	16.2.09	790	305	0·39
					Average rate per day =			0·65

TABLE V.—*continued.*

Reference No. of Bottle.	Position. Where Put Away.	Position. Where Recovered.	Depth of Water.	Date. When Put Away.	Date. When Recovered.	Number of Days.	Distance between Positions.	Average Rate per Day.
		GROUP III.						
	° ′ ° ′	° ′ ° ′						
162	58 22 N.; 1 45 W.	61 02 N.; 4 31 E. Utvaer Light, Norway.	70 fathoms.	20.11.06	15.4.08	511	248	0·48
192	58 17 N.; 1 04 W.	59 45 N.; 5 05 E. Melingsvaag, Norway.	On the beach.	15.8.06	11.11.08	818	210	0·26
205	57 24 N.; 0 11 E.	63 45 N.; 8 25 E. Homlingsvor Froien, near Kristiansund.	On the beach.	16.8.06	22.1.09	890	451	0·51
195	57 40 N.; 1 05 W.	59 08 N.; 5 17 E. Vigsnaes, Karmoën, Norway.	4 fathoms.	28.7.06	24.11.08	849	218	0·26
143	56 52 N.; 1 07 W.	61 46 N.; 4 53 E. Froien Island, Alansund, Norway.	--	21.10.06	11.2.08	478	346	0·73
				Average rate per day =				0·45
		GROUP IV.						
60	59 43 N.; 1 12 W.	70 40 N.; 22 38 E. 24 miles N.W. from Hammerfest.	(200 metres.)	12.6.06	25.4.07	317	883	2·78
175	58 15 N.; 1 09 W.	66 29 N.; 12 58 E. Indre Kvarö, Helqiland, Norway.	(400 feet.)	23.7.07	2.6.08	315	630	2·00
				Average rate per day =				2·39



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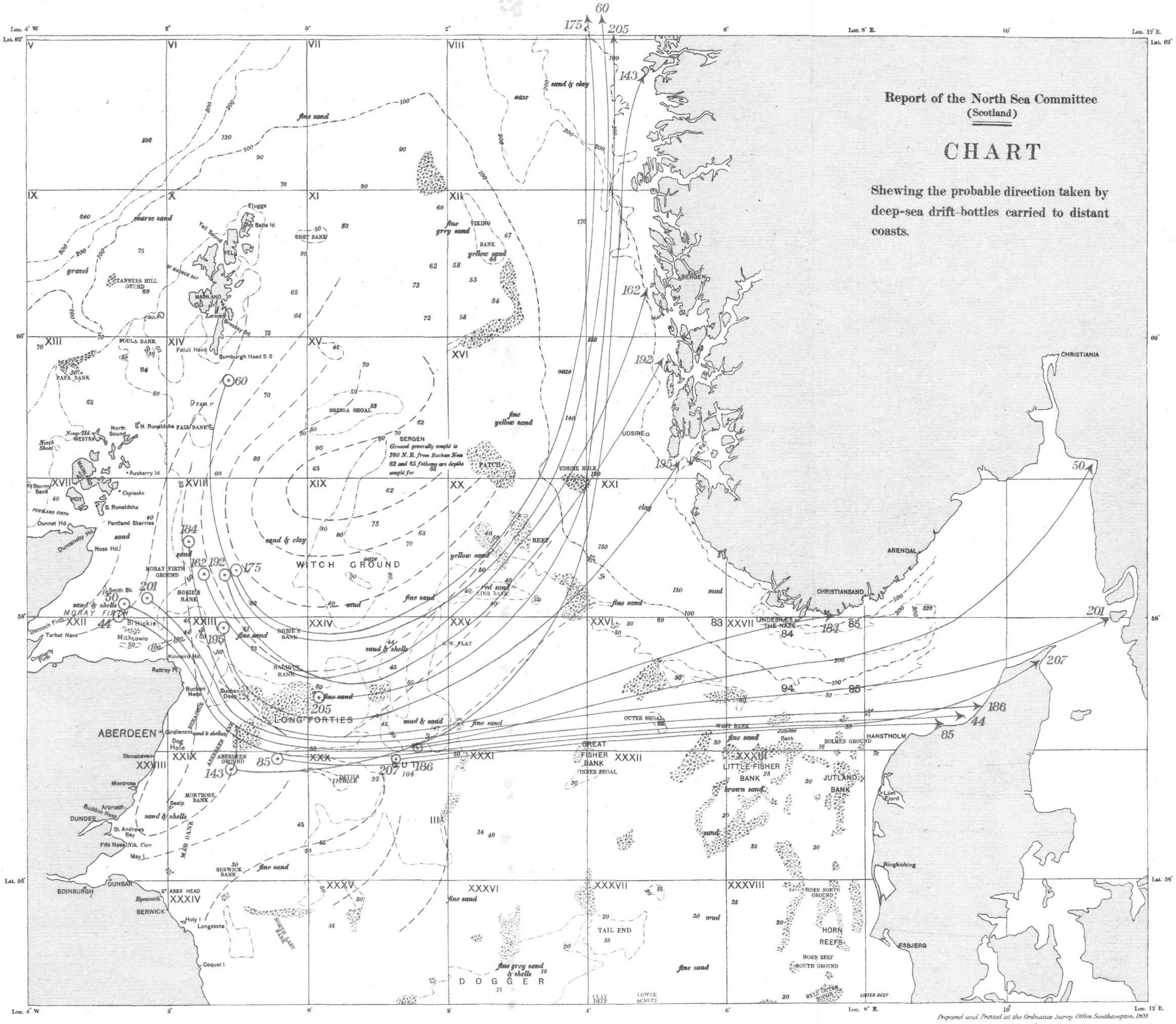


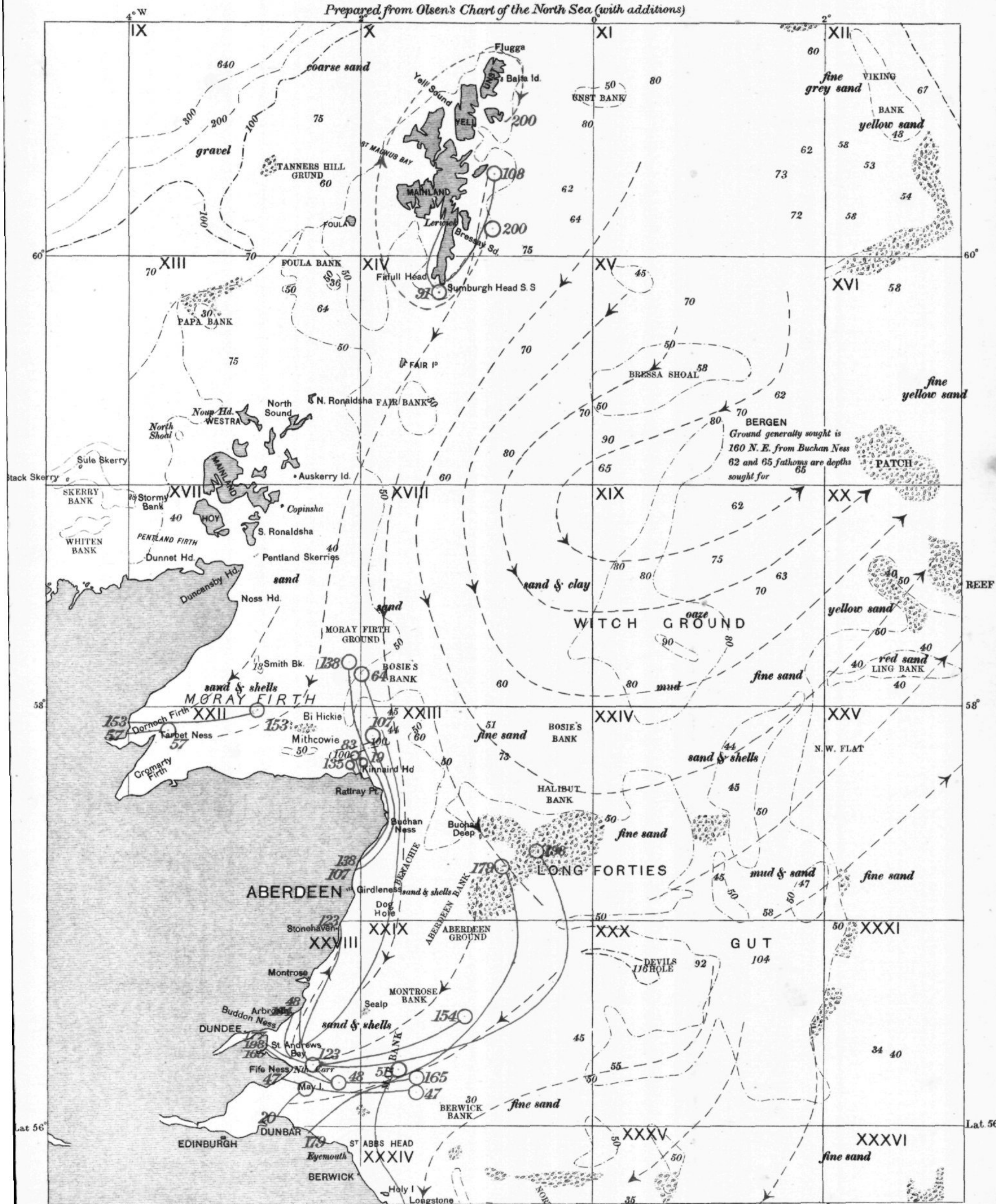
Prepared and Printed at the Ordnance Survey Office, Southampton, 1909

Report of the North Sea Committee
(Scotland)

Chart of the NORTH SEA

Shewing the probable direction taken by drift-bottles washed up on to Scottish Coast

Prepared from Olsen's Chart of the North Sea (with additions)



Prepared and Printed at the Ordnance Survey Office Southampton. 1909.

REPORT

ON

HYDROGRAPHIC INVESTIGATIONS

IN THE

NORTH SEA AND FAEROE-SHETLAND CHANNEL DURING THE YEARS 1907–1908.

BY

A. J. ROBERTSON, D.Sc.

CONTENTS.

(WITH 9 PLATES).

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THE HYDROGRAPHY OF THE NORTH SEA, 1907-1908.

THE ABERDEEN-SHETLAND AREA. (Plate I.)

The material available for the year 1907 over the Aberdeen-Shetland area consists of observations taken during February, May, August and November, and the resulting sections indicate very clearly the changes which took place throughout that year in the volume of Atlantic water entering the North Sea through the channels south of Shetland.

When the February observations were taken, the usual spring inflow from the Atlantic had set in, the whole area northward of Station 3 being at that time flooded by salt water of 35·25 per mille and over. Two tongues of maximum salinity marked the progress of the inflow round the north and south of Shetland respectively. At the more southerly stations the salinity was greatest in the surface layers, indicating the southward movement of Atlantic water towards the Scottish coast.

Three months later, in the second week of May, the distribution of Atlantic water was considerably more extensive, the 35 per mille isohaline having in the meantime moved southwards to within some 20 miles of the Scottish coast. The two tongues of 35·25 per mille water were again in evidence in the neighbourhood of Shetland, where they were separated by a wedge of slightly less saline water in the region of Station 5.

The hydrographic conditions during the spring and early summer of 1907 thus corresponded closely with those existing in previous years since the start of the investigations in 1902, the gradual increase in the Atlantic inflow during the earlier months to a maximum in April or May being now regarded as a well-established seasonal change. If the agreement during 1907 were to continue still further, we should expect to find a diminution in the Atlantic supplies by the time the August observations were taken. In contrast to previous years, however, an even more extensive Atlantic distribution was then shown, the whole area from Station 26 northwards being at that time flooded by water of 35·2 per mille and over, which in the bottom layers penetrated within a few miles of the Scottish coast. We must, accordingly, in the light of former evidence, look upon the summer Atlantic inflow of 1907 as an unusually extensive one, and must recognize further that the period of maximum volume was delayed somewhat beyond the usual time.

When the November observations were taken, the distribution of salt water was particularly scanty over the whole region, no 35·2 per mille water then appearing at any point along the section. The greater portion of the section was, however, still flooded by water exceeding 35 per mille salinity, the value of which remained exceedingly constant over a distance of some 100 miles. The customary winter decrease in the Atlantic inflow was thus shown towards the close of 1907, but the change was more strongly marked than in previous years, probably on account of an unusual distribution having already set in over the surrounding regions.

The conditions shown in the beginning of the following year were, indeed, quite abnormal in character, no water of 35 per mille being at that time present in any part of the section. This is the only occasion since the start of the investigations in the autumn of 1902 in which Atlantic water has been absent from this region, and in which, instead of the normally-occurring extensive distribution of high salinities, the maximum value found was only 34·88 per mille, some four-tenths less than the normal. As the mean annual variation of salinity during the past five years has rarely exceeded one-tenth per mille over the greater part of this area, the distribution existing during the early part of 1908 was certainly abnormal in character. In place of the usual extensive Atlantic distribution, there then existed a body of fresh water some 50 miles wide, extending northwards beyond Shetland on the one hand and southward beyond Aberdeen on the other, and showing only the smallest variations in temperature and salinity over this distance of some hundreds of miles. As the result of the presence of this fresh-water barrier, the Atlantic inflow south of Shetland was then completely cut off, so that the only supplies of salt water entering the northern area of the North Sea during March, 1908, must have come round the north of Shetland. As we shall see later in studying the conditions at the entrance to the Norwegian Sea, the Atlantic distribution in the region north-east of Shetland was then particularly scanty, being, in fact, between the 61st and 62nd parallels, confined within limits only some 40 miles apart.

This southward movement of fresh water which took place during the early part of 1908 evidently originated in the western area of the Norwegian Sea near the East Icelandic Polar current, which current normally flows along the east coast of Iceland into the regions north of the Faeroes. Only under exceptional circumstances, however, can water of such character penetrate southwards beyond the Faeroe-Shetland Channel, the opposing flow of the northward-moving Atlantic stream being, under normal conditions, sufficiently powerful to prevent it. During the early part of 1908 unusual conditions must, accordingly, have prevailed in the surrounding regions, resulting in the powerful southward movement of Norwegian Sea water and Polar water which was in full force when the March observations were taken.

This fresh-water extension completely surrounded the Shetlands, as shown by the salinity values at *5a*, *5b*, 11, *11a* and 12, but in the absence of observations from the Faeroe-Shetland Channel, we are unable to determine its precise westward limit. It seems probable, however, that it then flooded a great part of the region north of the Channel, deflecting the Atlantic stream largely away from its normal limits, and causing such Atlantic water as did enter the North Sea at that time to assume the form of an under-current. This point will be more fully discussed in dealing with the hydrography of the Faeroe-Shetland Channel.

The hydrographic distribution during March, 1908, thus indicated a complete flooding of the Aberdeen-Shetland area with water of low salinity, which at that time entirely cut off the Atlantic inflow south of Shetland. When the next observations were taken in the beginning of June, the Atlantic flow had once more been resumed, and had displaced this fresh water from all parts of the section. The salinity, however, was still below the normal value over the entire area, corresponding to Atlantic water diluted to a considerable extent. The scanty salt-water distribution which prevailed over the North Sea area during the summer months was apparently partly explained by the conditions of the previous spring, large volumes of fresh water having been swept eastwards on the resumption of the Atlantic inflow south of Shetland, producing a diluting effect over a considerable area of the North Sea.

The salinities over the Aberdeen-Shetland route showed a considerable increase when the August observations were taken, the greater part of the section being then flooded by water exceeding 35·15 per mille. That month apparently marked the period of maximum Atlantic inflow during the year 1908, when the effect, however, was much less marked than in normal years. Within the next few weeks, the salinity showed a marked decrease over the whole area, and by the middle of September water of 35·2 per mille had almost entirely disappeared from the section. The beginning of September may consequently be regarded as the commencement, during that year, of the annual diminution in the Atlantic inflow, which normally continues throughout the winter months. This diminution was marked in an unusual degree by the beginning of the following November, when a great part of the section was flooded by water of less than 35 per mille, which water in the surface layers extended northwards beyond Station 5. East of Shetland, however, the salinity was somewhat higher than in the previous September, the value from surface to bottom remaining constant at 35·23 per mille.

Considerable variations from the normal have thus been found to exist in the hydrographic conditions over the Aberdeen-Shetland area during these two years. In 1907, the full force of the Atlantic inflow was unusually long-continued and its maximum period delayed beyond the normal time ; while in 1908, on the other hand, the Atlantic distribution was exceedingly scanty, more especially in the early part of the year, when water of 35 per mille was entirely absent from the section.

Shetland to Norway. (Plate II.)

Two lines of stations extend over the regions east of Shetland and both reach within a short distance of the Norwegian coast. One of these lines, including Stations 5*b*, 6, 7*c*, 7*b*, and 7*a*, follows a more or less easterly course, while the direction of the other (Stations 5*a*, 6, 7, 8) is a somewhat more northerly one. The material available over this area during the year 1907 is limited to a single complete set of observations in May, with a few isolated ones in August and November.

During May, 1907, the greater part of this region was flooded by water of high salinity, marking the southward inflow of Atlantic water into the North Sea. The centre of the flow appeared to lie near Station 6, on either side of which there extended a wedge of salt water of 35·3 per mille. The effect of Continental coast water was clearly marked as the most easterly points investigated, the surface salinity at Station 8 being, in consequence, reduced to 34·12 per mille.

This coastal effect was more clearly shown when the next observations were taken three months later, the fresh-water influence at that time extending westwards beyond Station 7, and the surface salinity at Station 8 having fallen to 33·4 per mille. As usual, however, the effect was mainly confined to the upper layers, the greater part of the section being then still flooded by salt Atlantic water. By the following November, a considerable reduction had taken place in the salinity of the waters near Shetland, but the usual salt Atlantic water was still present in the region of Station 6.

The next observations, taken in March 1908, show that the salt-water distribution east of Shetland, was then particularly small, this being, of course, quite in accordance with the conditions existing at the same time over the Aberdeen-Shetland area, which was then flooded by fresh water from the Norwegian Sea. This Norwegian Sea water extended some distance east of Shetland, so that the Atlantic distribution over these sections was exceedingly scanty. The only water of 35·2 per mille and over was found in the regions of Station 6, where it was entirely confined to a distance of some 20 miles. There still existed, however, a considerable volume of 35 per mille water, which was bounded on the west by the fresh Norwegian Sea water and on the east by water from the Continental coast. The distribution of this latter water then appeared to be more than usually extensive for such an early date, this being probably due to the abnormally small Atlantic inflow which was taking place at that time.

The summer observations for 1908 are limited to a few taken in the beginning of July at Stations 6, 6*a*, 7*a* and 8. The greater part of this area had, by that time, become once more flood ed b Atlantic water, on the eastward side of which there extended the usual fresh water from the Continental coast. During the latter part of September, the influence of this coastal water was distributed over a much wider area, its westward extension then reaching within some 60 miles of Shetland. Except in the deeper layers, Atlantic water was then mainly confined to the Shetland side, and the salinities were everywhere reduced considerably below the normal value.

Entrance from North Sea to Norwegian Sea. (Plate III.)

Observations from this area are available for May and August, 1907 and for March, July and September, 1908. Several new stations, situated well within the fresh-water area off the Norwegian Coast, were worked during the latter year, so that the section over this region now extends from the north-west of Shetland to within some 20 miles of Norway, a distance of about 180 miles.

During May, 1907, the greater part of this area was flooded by salt Atlantic water, marking the continuation of the northward flow from the Faeroe-Shetland channel to the Norwegian Sea. The deeper regions at Station 11*a* were, from 400 metres downwards, flooded by the usual cold bottom Norwegian Sea water of 34·8–34·9 per mille, the temperature at 1,300 metres depth being then—0·74°C. The hydrographic distribution over the eastward part of the section showed salt Atlantic water underlying a fresher layer which contained a considerable admixture from the Continental coast. The surface salinity at the most easterly point did not, however, fall below 34 per mille.

Except for a more marked fresh-water effect at Station 8, the conditions remained much the same when the next observations were taken three months later. The hydrographic distribution at the more westerly stations was almost identical, and indicated the usual salt waters of the northward-flowing Atlantic Stream overlying the slow southward-moving bottom water, which is in direct connection with the deeper regions of the Norwegian Sea. The surface salinity at Station 8 then fell to 33.4 per mille, but the westward fresh-water extension was unusually limited for the season and did not reach much beyond that station.

During March, 1908, the westward part of this section was entirely flooded by water from the western area of the Norwegian Sea, which during that month completely washed the Shetlands and extended southwards beyond Aberdeen. As already mentioned, the temperature and salinity of this water remained remarkably uniform over a very large area, the only exception being in the deeper regions north-east of Shetland. Thus at Station 11*a*, the temperature decreased rapidly from 200 metres downwards, but did not, even at 1,200 metres depth reach such a low limit as is commonly met with in the bottom water, north of the Wyville-Thomson ridge. The following data are of interest, both as showing the peculiar hydrographic distribution during March 1908 and as indicating the considerable changes which may take place within a comparatively short period even at the greatest depths :—

STATION 11*a* (61° 42′ N – 2° W.)

August 1907.			March 1908.		
Depth.	Temp. °C.	Salinity.	Depth.	Temp. °C.	Salinity.
0	10·45	35·26	0	7·25	34·90
100 m.	8·11	35·23	100 m.	6·62	34·81
300 m.	5·54	35·01	300 m.	3·59	34·60
1200 m.	–1·02	34·88	1200 m.	–0·36	34·51

During March, 1908, Stations 11, 11*a* and 12 were all included within this fresh-water area. It is unfortunate that there are no observations for that month from the Faeroe-Shetland channel, as we are thus unable to determine the westward limit of the water in question. We have already seen that no Atlantic water was at that time entering the North Sea through the channels south of Shetland, and the more northerly inflow round the north of Shetland must, presumably, have sunk between this fresher water and entered in the form of an under-current. The distribution during March 1908 over the region north of Shetland will be more fully discussed when dealing with the hydrography of the Faeroe-Shetland channel.

The July observations did not extend westwards beyond Station 10, but three new stations (8*a*, 8*b* and 8*c*) were worked for the first time during that month. The western part of the section was then flooded by salt Atlantic water, which did not, however, extend eastwards much beyond Station 9. Near the Norwegian coast, there were encountered belts of water of alternately increasing and decreasing salinity, as shown by the surface observations at Stations 8*a* and 8*b*. Thus the surface salinity at the latter station was then 33·3 per mille, while at Station 8*a*, situated some 10 miles to the westward, the value was nearly 2 per mille less.

All the stations were worked in this area during September, 1908, the section for that month thus extending over a distance of about 180 miles. At Station 11*a* the usual conditions held good, viz., Atlantic water in the surface and Norwegian Sea water in the depths, the temperature at 1,200 metres then falling as low as –1·17°C. The centre of the Atlantic flow then appeared to lie between Stations 9 and 11, where the salinity varied from 35·2 to 35·3 per mille. The usual decrease of salinity was shown on passing towards the Norwegian coast, where the value in the region of Station 8 showed a decrease of more than 2 per mille in a distance of 20 miles.

During the years 1907 and 1908, the hydrographic conditions east and north-east of Shetland were thus much the same as formerly, except during the early part of 1908, when, on account of an abnormal southward movement of fresh water, the Atlantic distribution was particularly scanty. This southward movement originated in the western area of the Norwegian Sea near the East Icelandic Polar current, and resulted in the flooding of the regions south of Shetland with a mixture of Norwegian Sea water and Polar water, which completely cut off the Atlantic inflow between Shetland and Aberdeen. As regards the movements of the Continental inshore waters, our observations for these years are insufficient to determine the period of maximum westward extension. During the year 1908, however, these movements appear to have been more irregular than usual, and their effect was very marked at certain times over the more easterly area near the coast of Norway.

NORTH-WESTERN AREA. (Plate IV.)

Observations are available from this region for February, May, September and November, 1907, and for March, July and September, 1908, and the resulting sections show that the hydrographic conditions were, during these years, much the same as formerly.

During February, 1907, the greater part of this area was flooded by Atlantic water of moderate salinity, the maximum value being found in the vicinity of Station 25. As usual during the winter months, when the action of convection currents is most powerful, a very uniform surface to bottom temperature distribution was shown over the entire region. Towards the end of May, the well-marked density separation, which normally occurs over this area during the summer months, showed signs of setting in, but in no part of the section was there any indication of the presence of fresh water from the Continental coast.

No further observations were taken over this region till the first week in September, and by that date the maximum effect of the normally-occurring seasonal changes would be already past. There still existed, however, a well-marked separation of the waters into two layers, masses of cold bottom water of 6·7°C. underlying an upper warmer layer some 40 metres in thickness. The fall in temperature was very great at 40 metres depth, amounting to 3·5°C. in 10 metres.

This peculiar temperature distribution in the north-western area during the summer months is explained by the fact that the waters in these regions are in a continual state of rotation. Owing to the configuration of the North Sea bottom, the greater part of the Atlantic water entering the North Sea round the north and south of Shetland is carried back northwards before reaching the 57th parallel. East of Aberdeen, it bends round towards the Continental coast, where it becomes mixed up with a certain quantity of Baltic water and North Sea water, finally passing away northwards along the coast of Norway into the Norwegian Sea. That such a state of rotation does exist over this area has recently been proved by making use of experimental deep-water drift bottles. Several hundreds of these, weighted so as to float just clear of the bottom, were thrown overboard in the north-western area of the North Sea. Rather more than one-third have been recovered, and their positions when found prove conclusively that the waters over this region are in a state of cyclonic movement at all depths. This explanation accounts for the presence there during the summer months, of a cold deep-water area, which forms, in fact, the centre of the movement, and so remains more or less in a state of rest. It accounts, moreover, for the unequal temperature distribution at the various stations, the cold water in the central part of the rotation rising higher towards the surface than at the sides. A study of the temperature results at Stations 23 and 24 during September, 1907, illustrates this point:—

SEPTEMBER, 1907.

Station 23 (59° 31′ N.—0° 37′ E.)		Station 23 (59° 37′ N.—0° 37′ E.)	
Depth.	Temp. °C.	Depth.	Temp. °C.
0 m.	10·95	0 m.	10·65
40 m.	10·99	40 m.	10·86
50 m.	7·69	50 m.	9·82
60 m.	6·52	60 m.	7·26
100 m.	6·19	100 m.	6·37

When the next observations were taken, towards the close of November, the density separation had almost entirely disappeared, owing to a partial surface to bottom temperature equalisation having resulted from the action of convection currents. As previously explained, it is only during the colder months, when the powerful action of convection currents comes into play, that the displacement and renewal of the bottom layers in the north-western area is at all possible.

By the middle of March, 1908, a considerable reduction had taken place in the salinity over the entire area, in consequence of the flooding of the regions south of Shetland with fresh water from the Norwegian Sea. By the following July, the usual temperature separation had again taken place, the change from one water layer into the other being very distinct at a depth of about 40 metres. Two months later, in the third week of September, the temperature distribution had undergone but little change. The salinity, however, showed a considerable reduction at Station 23, due to the presence of Continental coast water in the northern part of the section.

The hydrographic conditions over the north-western area thus showed but slight variation from the normal during these two years, except for a somewhat more scanty salt-water distribution throughout the greater part of 1908. The changes which take place over this region, more particularly the summer and autumn temperature separation, are fully explained by the cyclonic movement of the waters, which, in turn, is accounted for by the configuration of the North Sea bottom. The velocity in the central part of this rotation is naturally small, and during the warmer months, when the action of convection currents is least powerful, the bottom waters over this region remain in a more or less stagnant condition, resulting in the well-marked density separation which normally occurs and which is quite independent of the salinity. Only during winter and spring, when the cooling down of the surface layers has brought into play the action of convection currents, can the bottom waters be displaced and renewed, and for this reason the warming of the deeper layers is subject to a great phase delay, the maximum annual temperature not being reached till near the close of the year.

Western Area of the North Sea.

Moray Firth line of Stations. (Plate V.)

During each of the years 1907 and 1908, the monthly cruise was carried out on five occasions, and the resulting sections show the conditions prevailing off the east coast of Scotland during that time.

The section extending eastwards from the Moray Firth includes Stations 28, 30, 32, 34, 36, 38 and 38*a*, and the changes taking place in the Atlantic inflow over the more northerly regions from Aberdeen to Shetland, are clearly reflected in the conditions shown at these stations. In the beginning of February, 1907, the westward limit of 35 per mille water reached within a few miles of Station 32, which investigations extending over the last four-and-a-half years show to be very near its normal position. Eastwards of this point, the salinities gradually increased on passing within the region of the southward-moving Atlantic inflow, the maximum value of 35·25 per mille being found at Station 38, the most easterly point investigated. During the next two months, apparently but little change took place over this area, except for a cooling-down of the waters as a whole, due to seasonal changes.

By the following July, however, the distribution of salt-water was unusually extensive, nearly the whole area being then flooded by water of high salinity, while the 35 per mille isohaline had moved into a position some 30 miles westward of the normal. As we have already seen in studying the Aberdeen-Shetland area, the summer Atlantic inflow of 1907 was much more extensive than usual, so that the salt-water distribution south of Shetland was greater during August than in the previous April. East of the Moray Firth, the centre of this inflow was then situated at Station 34, on either side of which there extended a wedge of water extending 35·25 per mille salinity. The top and bottom density separation, which we have already seen to be due to the cyclonic movement possessed by the waters in this region, had become established at the more easterly stations when the July observations were taken, this part of the section lying near the centre of the rotation where motion of the waters is naturally small.

When the September observations were taken, the westward boundary of 35 per mille water had once again taken up its normal position in the region of Station 32. The influence of Continental coast water was then strongly marked in the eastern part of the section, where the surface salinity fell considerably below 35 per mille. The Baltic Stream, spread out over the North Sea as a thin surface layer, must, accordingly, have at that time extended some 120 miles westward from the mouth of the Skagerrack. By the first week in November, this fresh surface water had retreated backwards towards the Continental coast, so that its influence was no longer evident even at the most easterly point on the section. By that time also, the density separation, which was still strongly marked when the September observations were taken, was in process of disappearing, although a bottom layer of cold water still existed from 60 metres downwards. Consequent on the particularly scanty salt water distribution over the Aberdeen-Shetland area during that month, the 35 per mille line had been displaced some 30 miles eastward of the normal position, these changes being apparently the first indication of the southward movement of fresh Norwegian Sea water which took place early in the following year.

The observations for January and February, 1908, show that the scanty salt-water distribution of the previous November still continued, and that the 35 per mille boundary still occupied a position some 30 miles east of the normal. These conditions are quite in accordance with the distribution existing between Aberdeen and Shetland during the same period, when the whole of that area was flooded by 34·8 per mille water from the Norwegian Sea. Consequent on the partial re-establishment of the Atlantic inflow south of Shetland, a somewhat greater salt-water distribution was shown over the Moray Firth line of stations when the April observations were taken, but the salinity still remained low over a great part of the section. Towards the end of July, the effect of Continental coast water was strongly marked over the eastern part of the section, where it penetrated in the surface layers westwards beyond Station 36. The Atlantic distribution was, in consequence, particularly scanty and was almost entirely confined to the deeper layers. Compared with the conditions existing over the same area the previous year, when the Atlantic inflow was unusually powerful, the section for July, 1908, shows the greatest possible difference, almost the only point in common being the density separation of the waters which normally takes place during the warmer months and which is quite independent of the salinity.

By the first week of October, the 35 per mille boundary had once more taken up its normal position in the region of Station 32 but the salinity remained very low over almost the entire area. This scanty distribution of Atlantic water still existed when the final observations for the year were taken in the first week of December, the 35 per mille line having in the meantime moved some 15 miles eastward beyond the usual position. The action of convection currents had by that time brought about a partial equalisation of temperature from surface to bottom, but cold water was still present in the deeper layers at Station 38. As already mentioned, the warming of the bottom waters over this area is subject to a great phase delay, so that the maximum annual temperature in the deeper layers is not reached till near the close of the year.

Observations from the Moray Firth line of stations illustrate an interesting point in connection with the cyclonic movement of the waters in the northern area of the North Sea, viz., that the cold bottom waters in the centre of the rotation rise nearest the surface and are the last to be renewed when the annual displacement takes place. A comparison of the temperature distribution shown during November, 1907, at Stations 36, 38 and 38*a* will make this clear, Station 38 occupying a position intermediate between the other two :—

Depth.	Station 36.	Station 38.	Station 38*a*.
	Temp. °C.	Temp. °C.	Temp. °C.
0 m.	9·35	9·35	9·55
60 m.	8·64	7·48	8·80
80 m.	8·02	6·45	7·22
100 m.	7·61	6·41	7·21

Since the start of the Moray Firth line of stations in September, 1904, observations have been taken on thirty occasions and some interesting points are shown by studying the results obtained. From September, 1904, to April, 1907, the westward limit of 35 per mille water varied but slightly from the region of Station 32, except on three occasions when comparatively great differences were shown. In January, 1905, the Atlantic circulation was unusually weak, so that water of 35 per mille salinity receded some 40 miles eastward beyond the usual limit ; in October, 1905, the Atlantic inflow was abnormally great, resulting in the movement of the 35 per mille boundary 20 miles nearer the Scottish coast ; and in May, 1906, the Atlantic distribution was again very extensive, so that it flooded a great part of the Moray Firth. Leaving out these three exceptional cases, the 35 per mille isohaline lay within ten miles of Station 32 on fifteen of the seventeen other occasions on which investigations were carried out between September, 1904, and April, 1907. Thus in the absence of more extensive observations, a rough indication of the hydrographic conditions existing over the north-western area might be arrived at by simply determining the westward limit of 35 per mille water in the regions east of the Moray Firth. Any marked variation from the normal position would tend to show that unusual conditions were then in evidence over the surrounding regions.

Such a variation was shown during July, 1907, when 35 per mille water was found some 30 miles nearer the Scottish coast, in accordance with the abnormally extensive Atlantic distribution which existed at that time over the Aberdeen-Shetland area. From November, 1907, onwards till the close of 1908, moreover, corresponding to the scanty Atlantic supplies which existed south of Shetland during that time, the 35 per mille boundary almost invariably took up a position considerably to the east of the normal, the average displacement away from the Scottish coast amounting to as much as 30 miles. The section extending between the most easterly points on the Moray Firth and Firth of Forth sections respectively, appears, during normal years, to be completely flooded by Atlantic water, except in the summer months when the distribution of coastal water is at a maximum. These conditions held good during 1907, an extensive Atlantic distribution in February being followed by a gradual decrease in salinity throughout the next few months. By the time the July observations were taken, the influence of coastal water was strongly marked at the more southerly stations, where the salinity fell somewhat below 35 per mille. The density separation was very marked throughout the summer and autumn at the stations along this section, the whole of which lies within the cold deep-water area. Even when the last observations for the year were taken in the first week of November, cold bottom layers were still present at most of the stations, the temperature distribution having undergone but little change up till that time.

Owing to the unusual hydrographic conditions of the year 1908, the Atlantic distribution was then much more limited over this section. During the earlier months (February to April) most of the stations were flooded by diluted Atlantic water, the salinity seldom rising above 35·15 per mille. Towards the end of July, very little Atlantic water was present in any part of the section, the 35 per mille boundary having retreated northwards far beyond its usual position, the difference, compared with July of the previous year, amounting to some 100 miles. The conditions shown in the beginning of October were somewhat more normal, but when the last observations for the year were taken in December an unusually scanty Atlantic distribution was again in evidence, water of 35 per mille having moved northwards some distance beyond the 57th parallel.

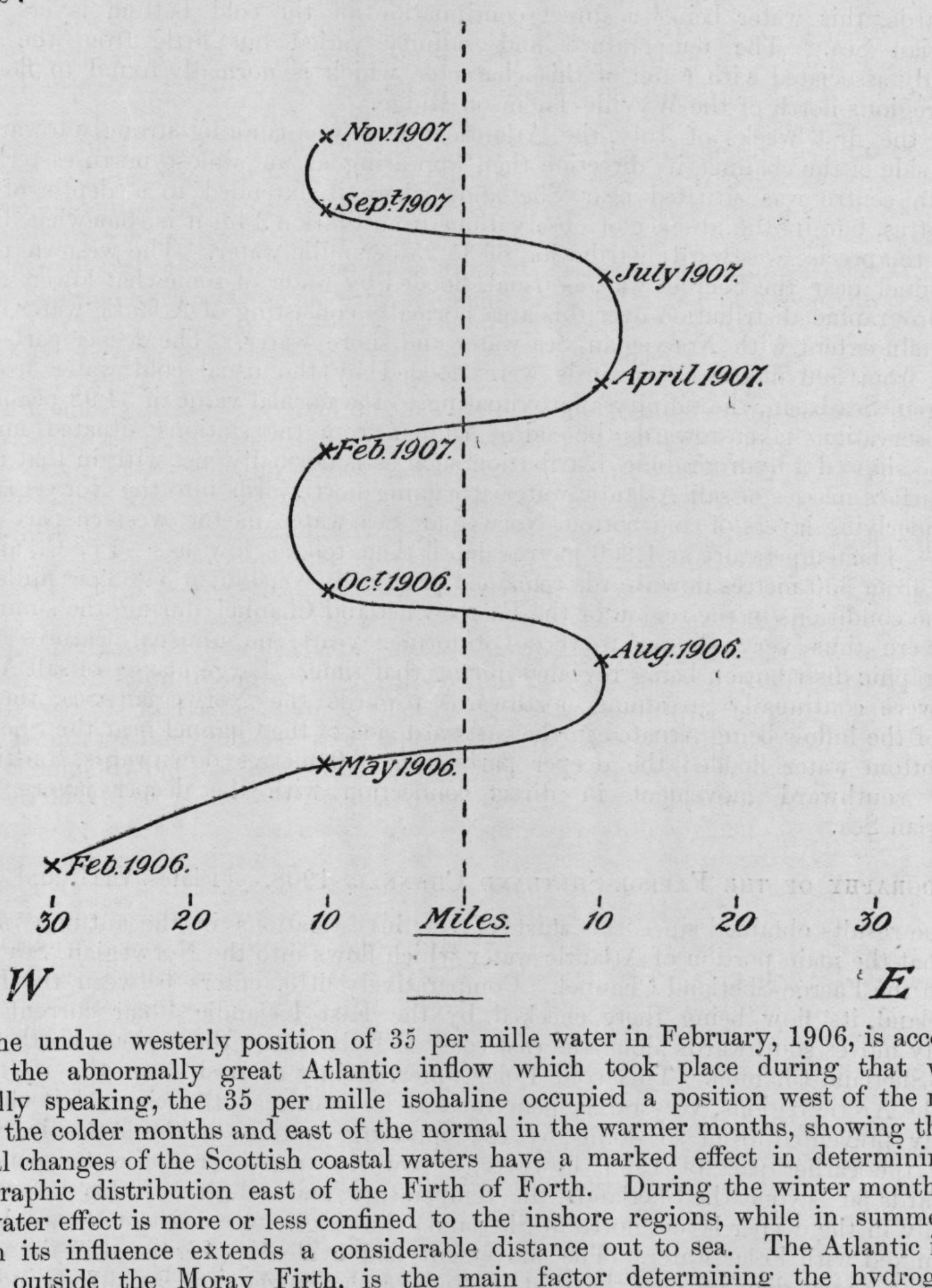
Firth of Forth line of Stations. (Plates VI. and VII.)

The line of stations extending eastwards from the Firth of Forth lies some 100 miles southwards of the parallel Moray Firth section already considered. As stated above, the southward Atlantic inflow into the North Sea bends round away from the Scottish coast before reaching the 57th parallel, in consequence of which the 35 per mille boundary normally occupies a more easterly position along the Firth of Forth line of stations than at the Latitude of the Moray Firth. As far as our investigations show, the average difference amounts to about 60 miles, the normal westerly limit east of the Firth of Forth for water of that salinity appearing to lie in the region of Station 41*c*.

The first section shows the conditions which existed east of the Firth of Forth during February, 1907, when the 35 per mille isohaline lay some 90 miles away from the Scottish coast, apparently not far from its normal position. East of Station 41*c*, the section was flooded by Atlantic water of moderate salinity, the maximum value of which was 35·2 per mille. Two months later, the 35 per mille line had moved some 20 miles seaward and the salinity all over showed a considerable decrease. Much the same distribution existed when the July observations were taken, except for the appearance of Continental coast water in the eastern part of the section. By the following September, 35 per mille water had again moved westwards towards the Scottish coast, then occupying a position intermediate between Stations 41*c* and 42. The temperature separation of the waters, which has already been discussed in dealing with the north-western area, was very marked over the eastern part of the section from July to September, a difference of 4° C. being on several occasions shown within a depth of 10 metres. When the last observations for 1907 were taken in the first week of November, the conditions had undergone but little change, except for a slight warming of the bottom waters in the eastern part of the section.

As already indicated, the distribution of salt Atlantic water over the North Sea area was particularly scanty during the year 1908, and this effect was, perhaps, most strongly marked east of the Firth of Forth. Throughout the greater part of the year, water of 35 per mille was entirely absent from the section, its westward boundary during that time being displaced some 50 miles seawards beyond the normal limit. The observations for February and April show that only in the extreme easterly part of the section was there then any indication whatever of Atlantic water, and throughout the remainder of the year, as shown by investigations in July, October and December, water of such character was entirely absent from all the stations. During the summer months, the usual density separation into layers took place, this change being, as already explained, brought about by the configuration of the North Sea bottom and being quite independent of the salinity.

When the monthly cruise was started in September, 1904, the Moray Firth line of stations was only carried some 60 miles east of the Scottish coast, and up till the end of 1905, when the section was extended some 70 miles out to sea, 35 per mille water had only been present on one occasion. This was in October, 1905, when an abnormal Atlantic inflow took place into the North Sea, so that the 35 per mille limit was displaced a considerable distance nearer the Scottish coast. Since the line was extended, it has become possible to study the behaviour of Atlantic water east of the Firth of Forth, and the average position of the 35 per mille boundary during the years 1906 and 1907 appears to have been somewhere in the region of Station 41*c*. Unlike the distribution eastwards of the Moray Firth, however, the 35 per mille limit at this latitude is subject to considerable changes from time to time, and theses changes appear, moreover, to be directly influenced by seasonal causes. A study of the following diagram, in which the dotted line represents the average position of the 35 per mille boundary, will show these changes :—



The undue westerly position of 35 per mille water in February, 1906, is accounted for by the abnormally great Atlantic inflow which took place during that winter. Generally speaking, the 35 per mille isohaline occupied a position west of the normal during the colder months and east of the normal in the warmer months, showing that the seasonal changes of the Scottish coastal waters have a marked effect in determining the hydrographic distribution east of the Firth of Forth. During the winter months, this fresh-water effect is more or less confined to the inshore regions, while in summer and autumn its influence extends a considerable distance out to sea. The Atlantic inflow, which, outside the Moray Firth, is the main factor determining the hydrographic distribution, is less powerful east of the Firth of Forth, the effect of coastal water being, in consequence, more marked. These fresh-water movements, a study of which may be conveniently carried on in this region, are accompanied by the transference of large quantities of pelagic eggs, larvae, &c., and are probably of considerable importance in regard to fishery problems, more especially in connection with the migration of the herring.

Hydrography of the Faeroe-Shetland Channel during the Summer of 1907. (Plate VIII.)

With the exception of a few observations taken from the stations north of Shetland in May and August, the material available for the region of the Faeroe-Shetland Channel is limited, during the year 1907, to a single series of observations in the beginning of July.

When the May observations were taken, the regions north and north-east of Shetland were flooded by water of high salinity, marking the northward continuation of the Atlantic inflow on its way to the Norwegian Sea. The centre of the inflow appeared to lie in the area between Stations 9 and 11*a*, where the salinity of the waters mainly exceeded 35·2 per mille. Station 11*a*, which lies within the deep-water area north of Shetland, was flooded by the usual cold water of moderate salinity from 400 metres downwards, this water being a direct continuation of the cold bottom layers in the Norwegian Sea. The temperature and salinity varied but little from the values commonly associated with water of this character, which is normally found to flood the deeper regions north of the Wyville-Thomson Ridge.

In the first weeks of July, the Atlantic inflow was running strongly towards the eastern side of the channel, its direction then appearing as an almost north-easterly one. Its main centre was situated near Shetland, where it extended to a depth of some 400 metres, but in the absence of observations from Station 14*a*, it is somewhat difficult to state the precise westward distribution of 35·25 per mille water. The western part of the channel near the Faeroes was, as usual, flooded by water of somewhat lower salinity, the hydrographic distribution over this area normally consisting of Atlantic water diluted to a certain extent with Norwegian Sea water and shore water. The deeper parts of the channel from 500 metres downwards were flooded by the usual cold water from the Norwegian Sea basin, the salinity approximating to the normal value of 34·92 per mille.

Observations taken towards the end of August from the stations situated north of Shetland showed a hydrographic distribution such as is normally met with in that region, viz.: surface masses of salt Atlantic water streaming northwards into the Norwegian Sea, with underlying layers of cold bottom Norwegian Sea water in the western part of the section. The temperature at 1,200 metres depth then fell as low as $-1·0°$ C., and the salinity from 350 metres downwards remained practically constant at 34·88 per mille.

The conditions in the region of the Faeroe-Shetland Channel during the summer of 1907 were thus very similar to those of former years, no unusual features in the hydrographic distribution being revealed during that time. Large masses of salt Atlantic water were continually streaming northwards towards the Norwegian Sea, the main centre of the inflow being situated in the eastward side of the Channel near the Shetlands. Cold bottom water flooded the deeper parts from 500 metres downwards, constituting a slow southward movement in direct connection with the deeper layers of the Norwegian Sea.

Hydrography of the Faeroe-Shetland Channel, 1908. (Plates VIII. and IX.)

The results obtained since the start of the investigations in the autumn of 1902 show that the main portion of Atlantic water which flows into the Norwegian Sea enters through the Faeroe-Shetland Channel. Comparatively little enters between the Faeroes and Iceland, its flow being there checked by the East Icelandic Polar current which normally moves southwards along the east coast of Iceland into the regions north of the Faeroe-Shetland Channel. This cold Polar water, mainly derived from the melting of ice in the Arctic regions, very rarely penetrates as far south as the channel itself, being normally prevented from so doing by the opposing motion of the Atlantic Stream. During the earlier part of 1908, however, a powerful movement of water penetrated southwards far beyond the Shetlands, the temperature and salinity of this water (more especially in the deeper layers north of Shetland) showing it to consist of Norwegian Sea water mixed with Polar water. The movement had evidently originated in the western area of the Norwegian Sea near the East Icelandic Polar current and, as already indicated, extended far enough south to completely cut off the Atlantic inflow south of Shetland. Whether the movement was due to a strengthening of the circulation in the Norwegian

Sea, or to an unusual diminution in the waters of the Atlantic Stream, can only be decided after all available material from the surrounding regions has been carefully worked up.

The Atlantic distribution north-east of Shetland during the earlier part of 1908 was, accordingly, somewhat limited, water of 35·2 per mille and over being, when the March observations were taken, entirely confined to a narrow wedge some 30 miles wide, bounded on either side by water of lower salinity. In the absence of observations from the Faeroe-Shetland Channel during that month, we are unable to determine the westward limit of the southward-moving Norwegian Sea water, but the probability is that it flooded the greater part of the region north of the channel. Any Atlantic water entering the North Sea or the Norwegian Sea during the early part of 1908 must, in consequence of the unusual conditions then existing, have first of all sunk down and passed underneath the opposing barrier of Norwegian Sea water, but the probability is that the Atlantic Stream was then largely deflected away from these regions and its flow to the east and north-east of Shetland to a great extent suspended. On the resumption of the full Atlantic inflow into the North Sea at a somewhat later date, its waters would become diluted in the regions south of Shetland by admixture with the fresher Norwegian Sea water, much of which would at the same time be swept eastwards into the North Sea area, resulting in a considerable reduction in the salinity throughout the following months. We have already seen that an unusually limited supply of salt water existed in the northern area of the North Sea during the summer and autumn of 1908, and the reason here stated must be taken as at least a partial explanation of this fact.

During March, 1908, the deeper regions north of Shetland were, as stated above, flooded from 400 metres downwards with a mixture of Norwegian Sea water and Polar water, the salinity of which remained constant at 34·5 per mille throughout a depth of 800 metres. The bottom temperature was then rather less than $-0{\cdot}5^\circ$ C., the deeper waters being thus somewhat warmer than is usually the case north of the Wyville-Thomson Ridge. The complete change in the temperature and salinity of the bottom layers at Station 11*a* compared with the previous August is of interest as showing the great variations which may take place within a comparatively short time even in the deepest regions of the sea.

A month later, towards the middle of April, the Atlantic Stream was running strongly in the eastern part of the channel, its main centre being then situated close to Shetland, and extending to a depth of about 400 metres. Its direction of flow appeared to be slightly more easterly than in the previous July, especially on the Shetland side where it probably encountered the opposing force of Norwegian Sea water. The temperature and salinity were considerably lower in the western area of the channel, indicating the usual mixture of Atlantic water, Norwegian Sea water and shore water, which is commonly associated with the region near the Faeroes. The cold water in the deeper layers was strongly banked up towards the western side of the channel, where it reached within 250 metres of the surface at the southerly stations. The temperature of this bottom water was, moreover, considerably above the average, the value at 1,000 metres depth being then about half-a-degree higher than usual.

A few observations taken in the southern section of the channel towards the middle of June show a somewhat more extensive salt-water distribution than in the previous April, the greater area being then flooded by water of 35·2 per mille and upwards. The highest salinities were once again found near the Shetland side, where water of 35·3 per mille and over extended to a depth of 400 metres. The only observations from the northern section during June, 1908, were those taken at Stations 13*a* and 15*c* (situated between 15*a* and 15*b*), so that it is somewhat difficult to determine exactly the hydrographic distribution for that month. Station 13*a* was then flooded by 35·3 per mille water to a considerable depth, while Station 15*c*, although clearly situated outside the main flow, was nevertheless flooded by water of moderate salinity. As indicated by the density distribution in the region of the channel, the Atlantic stream then appears to have followed a more or less north-easterly course in its passage towards Shetland, with a direction very similar to that of the previous July. The bottom temperature at Station 19*a* had decreased by over half-a-degree since the April observations were taken, showing that considerable changes may take place in the conditions at 1,000 metres depth even within the space of two months.

The material available for August, 1908, includes observations from Station 19*a* in the southern section of the channel and from most of the stations in the northern section. During that month, the Atlantic stream apparently assumed a winding course, so that its full effect was experienced at the most westerly and most easterly stations in the northern section, but not at intermediate points. The salt-water distribution was, accordingly, most scanty in the central regions of the channel where the salinity fell below 35 per mille. These conditions suggest the presence of Norwegian Sea water, which at that time apparently extended far enough southwards to flood part of the northern station, and to influence the direction of the Atlantic stream in its flow across channel. During that month, also, the bottom temperatures were unusually low, the value at 1,200 metres depth being only $-1{\cdot}2°$ C. The distribution of Atlantic water in the northern section then seems, in fact, to have been particularly scanty, especially in the central regions, where the influence of Norwegian Sea water was very marked at all depths.

Similar conditions prevailed in the northern region of the channel during the first week of November, except for a slight increase of salinity over the central area. The distribution of 35·2 per mille water was, however, somewhat more scanty, and evidence of Norwegian Sea water was again noticeable in the central regions, where the salinity was affected to a depth of 100 metres. In the southern section, the salt-water distribution appeared to be much more extensive, most of the stations being flooded by 35·25 per mille water to 300 metres depth. As explained in a former report, this apparent difference in the conditions over the northern and southern sections is due to the direction of flow assumed by the Atlantic stream in its passage across channel. During that month, it appeared to pass south of the Faeroes flowing in an easterly direction, which only changed to a more northerly one near the Shetland side. In the western part of the channel, the Atlantic flow would thus be along the southern section, not across it, so that the salt-water distribution at these stations appeared much more extensive than was really the case.

With the probable exception of the early part of 1908, Atlantic water has thus, during the last two years, been continually streaming northwards into the Norwegian Sea, and its direction of flow within the regions of the Faeroe-Shetland Channel appears to have varied, during that time, between north-east and east. Throughout 1908, the influence of Norwegian Sea water appears to have been unusually powerful in the regions north of the channel, especially during the earlier months when water of such character penetrated southwards far beyond the Shetlands. As will subsequently be seen, further evidence in support of most of the above conclusions may be derived by studying the conditions of the Faeroe-Shetland Channel from a hydrodynamical point of view.

Hydrodynamical Treatment of the Conditions of the Faeroe-Shetland Channel during 1906 and 1907.

As already indicated in former reports, considerable assistance in regard to the movements of the waters may sometimes be derived by treating the conditions from a hydrodynamical point of view, and calculations based upon the differences in density may, in certain cases, give a rough indication of the actual velocity of the currents. The principle assumed in making these calculations is embodied in the statement that the lighter water is, in general, found on the right-hand side in the direction in which the current is flowing, provided always that the velocity is greatest in the surface and that it decreases with increasing depth. Where the maximum velocity exists at some distance beneath the surface, the reverse conditions hold good, the lighter water being in such cases present on the left-hand side. As previously explained, 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 directly proportional to the velocity of the current. Consequently, in order to prevent a screw circulation being set up, the densities must be distributed in the manner indicated above, and results calculated from these differences of density only hold good in cases where no such screw circulation exists. An example of the above conditions is supplied by the region of the sea extending from Aberdeen to Shetland, where the density of the water almost invariably shows a gradual increase from Aberdeen northwards, such as would naturally be associated with the eastward flow of Atlantic water into the North Sea.

For the region of the Faeroe-Shetland Channel, calculations based on these lines have been made from all observations available for the years 1906 and 1907, the results obtained indicating, of course, not the actual velocities, but the differences taking place in the rate of flow from the surface downwards. As formerly explained, the highest values are found when the calculations are made along lines which are crossed vertically by the current in question, so that by calculating the differences in various ways and studying the results obtained, some indication as to the direction of flow of the currents may be arrived at. In the case of the central regions of the Faeroe-Shetland Channel, moreover, if the bottom waters are supposed to move but slowly, the maximum values obtained may be taken as supplying a rough indication of the actual surface velocity.

In reference to calculations carried out across channel from east to west, positive values indicate, as on previous occasions, that the lighter water was present at the more easterly station ; negative values, for calculations made under similar conditions, indicate that the lighter water was found at the more westerly position. Where the differences of velocity were estimated across channel from north to south, 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-SHETLAND CHANNEL, JULY 1907.

Velocity difference from	Calculated between Stations along Northern Section.			
	16*a*–16.	15*b*–16*a*.	15*a*–15*b*.	13*a*–15*a*.
0–30 metres	+0·70 $\frac{cm}{sec}$	−0·15 $\frac{cm}{sec}$	−0·10 $\frac{cm}{sec}$	+0·38 $\frac{cm}{sec}$
0–50 „	+1·00 „	−0·40 „	−0·15 „	+0·47 „
0–100 „	+0·60 „	−0·85 „	−0·15 „	+0·85 „
0–200 „	—	−0·60 „	−0·25 „	+1·50 „
0–250 „	—	−0·65 „	−0·30 „	—
0–300 „	—	—	—	+2·35 „
0–400 „	—	—	—	+4·20 „
0–500 „	—	—	—	+6·70 „

FAEROE-SHETLAND CHANNEL, JULY 1907.

Velocity difference from	Calculated between Stations along Southern Section.					
	17–18*a*.	18*a*–19*a*.	19*a*–19*b*.	19*b*–20*a*.	20*a*–21*a*.	21*a*–21.
0–30 metres ...	+0·75 $\frac{cm}{sec}$	−0·20 $\frac{cm}{sec}$	+0·08 $\frac{cm}{sec}$	+1·25 $\frac{cm}{sec}$	+0·85 $\frac{cm}{sec}$	−1·14 $\frac{cm}{sec}$
0–50 „ ...	+1·30 „	−0·30 „	+0·15 „	+2·10 „	+1·10 „	−1·90 „
0–100 „ ...	+2·15 „	−0·60 „	+0·50 „	+3·65 „	+1·05 „	−2·60 „
0–150 „ ...	—	—	—	+5·20 „	—	—
0–200 „ ...	—	−0·65 „	+1·20 „	—	—	—
0–300 „ ...	—	−0·60 „	+2·25 „	—	—	—
0–400 „ ...	—	—	—	—	—	—
0–500 „ ...	—	—	+8·60 „	—	—	—

FAEROE-SHETLAND CHANNEL, JULY 1907.

Velocity difference from	Calculated between Stations in Northern and Southern Sections.							
	13*a*–19*a*.	13*a*–19*b*.	15*a*–18*a*.	15*a*–19*a*.	15*a*–19*b*.	15*b*–18*a*.	15*b*–19*a*.	15*b*–19*b*.
0–30 m.	−0·07 $\frac{cm}{sec}$	−0·05 $\frac{cm}{sec}$	+0·27 $\frac{cm}{sec}$	+0·20 $\frac{cm}{sec}$	+0·20 $\frac{cm}{sec}$	+0·25 $\frac{cm}{sec}$	+0·15 $\frac{cm}{sec}$	+0·15 $\frac{cm}{sec}$
0–50 „	−0·35 „	+0·03 „	+0·40 „	+0·30 „	+0·35 „	+0·40 „	+0·20 „	+0·20 „
0–100 „	−0·15 „	+0·03 „	+0·70 „	+0·50 „	+0·65 „	+0·80 „	+0·35 „	+0·45 „
0–200 „	−0·40 „	−0·05 „	—	—	—	+0·90 „	+0·40 „	+0·70 „
0–300 „	−0·80 „	−0·22 „	+0·85 „	+0·65 „	+1·45 „	—	—	—
0–400 „	−1·90 „	−0·80 „	—	—	—	—	—	—
0–500 „	−2·90 „	−0·50 „	—	+1·10 „	+4·30 „	—	—	—
0–800 „	—	—	—	+0·15 „	—	—	—	—

Faeroe-Shetland Channel, April 1908.

Velocity difference from	Calculated between Stations in Northern Section.				
	16*a*–16.	15*b*–16*a*.	15*a*–15*b*.	14*a*–15*a*.	13*a*–14*a*.
0–30 metres	−0·10 cm/sec	+0·05 cm/sec	−0·07 cm/sec	+0·60 cm/sec	−0·07 cm/sec
0–50 „	−0·16 „	+0·12 „	−0·05 „	+0·85 „	−1·04 „
0–100 „	−0·31 „	+0·40 „	+0·10 „	+1·25 „	−1·95 „
0–200 „	—	+1·62 „	−0·13 „	+1·45 „	−2·84 „
0–300 „	—	—	−1·00 „	—	−5·83 „
0–400 „	—	—	−2·35 „	+3·68 „	−3·25 „
0–500 „	—	—	—	+5·91 „	−0·89 „
0–700 „	—	—	—	+6·96 „	—
0–1000 „	—	—	—	+3·63 „	—
0–1200 „	—	—	—	+0·60 „	—

Faeroe-Shetland Channel, April 1908.

Velocity difference from	Calculated between Stations in Southern Section.					
	17–18*a*.	18*a*–19*a*.	19*a*–19*b*.	19*b*–20*a*.	20*a*–21*a*.	21*a*–21.
0–30 metres ...	−0·12 cm/sec	+0·13 cm/sec	+0·40 cm/sec	−0·07 cm/sec	−0·31 cm/sec	−0·10 cm/sec
0–50 „ ...	−0·17 „	+0·26 „	+0·70 „	−0·18 „	−0·55 „	−0·15 „
0–100 „ ...	−0·34 „	+0·68 „	+1·20 „	−0·33 „	−1·10 „	−0·55 „
0–170 „ ...	—	—	—	−0·65 „	−2·00 „	—
0–200 „ ...	—	—	+2·20 „	—	—	—
0–250 „ ...	—	+2·12 „	—	—	—	—
0–400 „ ...	—	—	+6·00 „	—	—	—
0–600 „ ...	—	—	+19·75 „	—	—	—

Faeroe-Shetland Channel, April 1908.

Velocity difference from	Calculated between Stations in the Northern and Southern Sections.											
	13*a*–19*a*.	13*a*–19*b*.	14*a*–18*a*.	14*a*–19*a*.	14*a*–19*b*.	14*a*–20*a*.	15*a*–18*a*.	15*a*–19*a*.	15*a*-19*b*.	15*b*-18*a*.	15*b*–19*a*.	15*b*–19*b*.
0-30 metres	+0·02 cm/sec	+0·15 cm/sec	−0·05 cm/sec	Nil	+0·15 cm/sec	+0·12 cm/sec	+0·12 cm/sec	+0·20 cm/sec	+0·35 cm/sec	+0·10 cm/sec	+0·15 cm/sec	+0·25 cm/sec
0-50 „	+0·30 „	+0·60 „	−0·10 „	+0·01 cm/sec	+0·95 „	+0·20 „	+0·15 „	+0·30 „	+0·55 „	+0·15 „	+0·25 „	+0·40 „
0-100 „	+0·65 „	+1·20 „	−0·20 „	+0·10 „	+0·60 „	+0·50 „	+0·15 „	+0·60 „	+1·00 „	+0·25 „	+0·60 „	+0·85 „
0-170 „	—	—	—	—	—	+1·05 „	—	—	—	—	—	—
0-200 „	+1·30 „	+2·35 „	—	—	+1·55 „	—	—	—	+2·00 „	—	+1·35 „	+1·75 „
0-250 „	—	—	+0·45 „	—	—	—	+0·45 „	—	—	+0·20 „	—	—
0-300 „	+2·90 „	—	—	+1·20 „	—	—	—	+2·35 „	—	—	+1·55 „	—
0-400 „	+2·75 „	+5·30 „	—	—	+4·80 „	—	—	—	+5·85 „	—	−2·15 „	+3·50 „
0-500 „	+1·85 „	+6·05 „	—	+2·65 „	—	—	—	+5·15 „	—	—	—	—
0-600 „	—	—	—	—	+10·65 „	—	—	—	+13·00 „	—	—	—
0-700 „	—	—	—	+3·10 „	—	—	—	+6·05 „	—	—	—	—
0-800 „	—	—	—	—	—	—	—	—	—	—	—	—
0-1000 „	—	—	—	+3·90 „	—	—	—	+5·70 „	—	—	—	—

FAEROE-SHETLAND CHANNEL, JUNE 1908.

Velocity difference from	Calculated between Stations in Southern Section.		
	17–18*a*.	18*a*–19*a*.	19*a*–19*b*.
0–30 metres	+0·40 cm/sec	+0·55 cm/sec	+ 0·10 cm/sec
0–50 ,, ...	+0·65 ,,	+0·70 ,,	+ 0·40 ,,
0–100 ,, ...	+1·05 ,,	+0·70 ,,	+ 2·05 ,,
0–200 ,, ...	—	+0·75 ,,	+ 6·10 ,,
0–300 ,, ...	—	−0·35 ,,	—
0–350 ,, ...	—	—	+16·90 ,,

FAEROE-SHETLAND CHANNEL, JUNE 1908.

Velocity difference from	Calculated between Stations in Northern and Southern Sections.				
	13*a*–19*a*.	13*a*–19*b*.	15*c*–18*a*.	15*c*–19*a*.	15*c*–19*b*.
0–30 metres	+0·40 cm/sec	+0·55 cm/sec	−0·02 cm/sec	+0·30 cm/sec	+0·30 cm/sec
0–50 ,, ...	+0·65 ,,	+0·90 ,,	+0·05 ,,	+0·50 ,,	+0·55 ,,
0–100 ,, ...	+1·05 ,,	+1·95 ,,	+0·60 ,,	+1·05 ,,	+1·60 ,,
0–200 ,, ...	+1·70 ,,	+4·10 ,,	+0·40 ,,	+0·85 ,,	+2·85 ,,
0–300 ,, ...	+1·00 ,,	—	+0·35 ,,	+0·10 ,,	—
0–350 ,, ...	+0·08 ,,	+5·90 ,,	—	—	+5·55 ,,
0–400 ,, ...	−0·80 ,,	—	—	−1·50 ,,	—
0–500 ,, ...	—	—	—	−2·55 ,,	—
0–550 ,, ...	−3·65 ,,	—	—	—	—
0–600 ,, ...	—	—	—	−3·20 ,,	—
0–700 ,, ...	—	—	—	−3·40 ,,	—
0–750 ,, ...	—	—	—	−3·45 ,,	—

FAEROE-SHETLAND CHANNEL, AUGUST, 1908.

Velocity difference from	Calculated between Stations in Northern Section.				
	16*a*–16.	15*b*–16*a*.	15*a*–15*b*.	14*a*–15*a*.	13*a*–14*a*.
0–30 metres... ...	+0·80 cm/sec	+0·35 cm/sec	+0·15 cm/sec	Nil.	+ 0·25 cm/sec
0–50 ,, ...	+1·15 ,,	+0·20 ,,	+0·10 ,,	− 0·20 cm/sec	+ 0·55 ,,
0–100 ,, ...	+0·40 ,,	−0·80 ,,	−0·50 ,,	+ 0·08 ,,	+ 1·88 ,,
0–200 ,, ...	—	−1·95 ,,	−1·30 ,,	+ 0·15 ,,	—
0–300 ,, ...	—	—	—	+ 2·30 ,,	+ 8·55 ,,
0–409 ,, ...	—	—	−6·95 ,,	+ 6·15 ,,	+13·55 ,,
0–500 ,, ...	—	—	—	—	+20·40 ,,
0–600 ,, ...	—	—	−7·75 ,,	+10·35 ,,	—
0–1000 ,, ...	—	—	—	+13·45 ,,	—

FAEROE–SHETLAND CHANNEL, AUGUST, 1908.

Velocity difference from	Calculated between Stations in Northern and Southern Sections.			
	13*a*–19*a*.	14*a*–19*a*.	15*a*–19*a*.	15*b*–19*a*.
0–30 metres	−0·15 cm/sec	−0·10 cm/sec	−0·10 cm/sec	Nil.
0–50 „	−0·12 „	+0·07 „	Nil.	+0·05 cm/sec
0–100 „	−0·35 „	+0·28 „	+0·35 „	+0·03 „
0–200 „	−1·10 „	+0·50 „	+0·60 „	−0·20 „
0–300 „	−1·85 „	+1·00 „	+2·00 „	−0·30 „
0–500 „	−4·70 „	+2·00 „	+5·70 „	+0·13 „
0–600 „	—	+1·85 „	+6·05 „	+0·85 „
0–1000 „	—	+0·15 „	+5·25 „	—

VELOCITY DIFFERENCE BETWEEN STATIONS 11*a* AND 12, 1907–8.

Velocity difference from	May 1907.	Aug. 1907.	March 1908.	Sept. 1908.
0–30 metres	+0·06 cm/sec	+0·10 cm/sec	+0·035 cm/sec	+0·05 cm/sec
0–100 „	+0·09 „	+0·10 „	+0·030 „	+0·70 „

FAEROE–SHETLAND CHANNEL, NOVEMBER 1908.

Velocity difference from	Calculated between Stations in Northern Sections.				
	16*a*–16.	15*b*–16*a*.	15*a*–15*b*.	14*a*–15*a*.	13*a*–14*a*.
0–30 metres... ...	−0·25 cm/sec	+0·08 cm/sec	+0·30 cm/sec	− 0·10 cm/sec	Nil.
0–50 „	−0·40 „	−0·02 „	+0·45 „	− 0·30 „	Nil.
0–100 „	−0·90 „	−0·20 „	+0·70 „	− 0·90 „	+ 0.40 cm/sec
0–200 „	—	−1·60 „	+0·75 „	− 0·55 „	+ 3·70 „
0–300 „	—	—	+0·15 „	− 9·60 „	+ 8·95 „
0–370 „	—	—	−1·20 „	—	—
0–400 „	—	—	—	−14·30 „	—
0–500 „	—	—	—	—	+24·30 „
0–600 „	—	—	—	−18·0 „	+31·90 „
0–1000 „	—	—	—	−22·6 „	—
0–1300 „	—	—	—	—	—

FAEROE–SHETLAND CHANNEL, NOVEMBER 1908.

Velocity difference from	Calculated between Stations in Southern Section.					
	17–18*a*.	18*a*–19*a*.	19*a*–19*b*.	19*b*–20*a*.	20*a*–21*a*.	21*a*–21.
0–30 metres ...	+0·15 cm/sec	+0·02 cm/sec	+0·50 cm/sec	2·10 cm/sec	+0·45 cm/sec	−0·45 cm/sec
0–50 „ ...	+0·50 „	−0·01 „	+1·00 „	3·50 „	+0·60 „	−0·90 „
0–100 „ ...	+0·80 „	−0·35 „	+2·55 „	6·75 „	+1·15 „	−3·70 „
0–200 „ ...	—	−0·65 „	+6·50 „	13·25 „	—	—
0–300 „ ...	—	−1·50 „	+10·05 „	—	—	—
0–500 „ ...	—	—	+20·65 „	—	—	—

FAEROE-SHETLAND CHANNEL, NOVEMBER, 1908.

Velocity difference from	Calculated between Stations in Northern and Southern Sections.											
	13*a*-19*a*.	13*a*-19*b*.	14*a*-18*a*.	14*a* 19*a*.	14*a*-19*b*.	14*a*-20*a*.	15*a*-18*a*.	15*a*-19*a*.	15*a*-19*b*.	15*b*-18*a*.	15*b*-19*a*.	15*b*-19*b*.
0-30 metres	-0·05 cm/sec	+0·10 cm/sec	-0·05 cm/sec	-0·05 cm/sec	+0·15 cm/sec	+0·60 cm/sec	-0·10 cm/sec	-0·10 cm/sec	+0·10 cm/sec	Nil	+0·02 cm/sec	-0·15 cm/sec
0-50 "	-0·10 "	+0·20 "	-0·07 "	-0·10 "	+ 0·25 "	+1·00 "	-0·20 "	-0·20 "	+0·15 "	+0·05 cm/sec	+0·05 "	+0·30 "
0-100 "	-0·25 "	+0·55 "	Nil.	-0·20 "	+ 6·80 "	+2·20 "	-0·30 "	-0·55 "	+0·45 "	+0·10 "	-0·10 "	+6·65 "
0-200 "	—	—	+0·50 "	+0·35 "	+ 2·90 "	+5·60 "	-0·85 "	—	—	-0·55 "	-0·75 "	+1·30 "
0-300 "	-1·30	+1·95 "	+1·80 "	+1·60 "	+ 5·75 "	—	-0·75 "	-1·80 "	+2·20 "	-0·80 "	-1·50 "	+1·80 "
0-400 "	—	—	—	—	+ 9·25 "	—	—	—	—	—	—	—
0-500 "	-3·70	+2·70 "	—	+4·25 "	+12·65 "	—	—	-1·60 "	+6·30 "	—	—	—
0-800 "	—	—	—	+4·35 "	—	—	—	-2·75 "	—	—	—	—
0-1000 "	—	—	—	+4·15 "	—	—	—	-3·80 "	—	—	—	—

During July 1907, the density of the water showed a gradual increase on passing westwards from Shetland towards the central regions of the channel, this distribution corresponding to the northward flow of the Atlantic stream which, as we have already seen, was at that time mainly confined to the eastern side. The greatest velocity differences were found between Stations 13*a* and 15*a* in the northern section and 19*b* and 20*a* in the southern, but the values were, in all cases, somewhat smaller than usual. The direction of flow of the Atlantic stream across channel then seems to have been an almost due north-easterly one, as shown by the very small differences of velocity found along the line joining Stations 13*a* and 19*a*. Its rate of flow appears to have been somewhat less than in the previous summer, when the value found was about 12 miles in 24 hours. It is interesting to note, in this connection, that Danish investigators have lately calculated the annual average velocity of the current in the sea between the north coast of Scotland and the nucleus of the Atlantic stream to be about five miles in 24 hours, so that within the regions of the main Atlantic flow, the average is probably considerably greater.

In the central parts of the channel, there was apparently a slow southward movement at the time when the July observations were taken, but the differences of density were in all cases small and uncertain. Near the Faeroes, the direction of flow was northwards, the velocity being about a mile per day less at a depth of 100 metres than in the surface layers.

During April 1908, there was the usual northward movement in the eastern part of the channel, the density distribution between Stations 13*a* and 14*a* indicating, however, a northward-flowing current with a maximum velocity at 300 metres depth, where the rate of flow was some three miles per 24 hours greater than at the surface. These unusual conditions were probably caused by the opposing influence of Norwegian Sea water, which, as we have already seen, extended southwards beyond Shetland during the early part of 1908. The Atlantic stream, in order to enter the Norwegian Sea, would thus be forced to sink down and pass underneath this fresher water, and this would naturally result in a diminution of the rate of flow in the upper layers. The density distribution along the lines connecting Stations 13*a*-19*b* and 19*a*-19*b* shows that the Atlantic flow then cut these lines at appproximately equal angles, so that its flow across channel was somewhat more easterly than in July of the previous year. Towards the Shetland side it appears, moreover, to have turned nearly due east, as shown by the comparatively small differences of velocity found between stations in this region. Assuming that the waters between Stations 19*a* and 19*b* were then in a state of rest at 600 metres depth, and allowing for the fact that the Atlantic stream followed a north-easterly course in its passage across channel, the rate of flow of the surface waters appears at that time to have amounted to some 15 miles per day.

In June 1908, the only Stations worked were 13*a* and 15*c* in the northern section of the channel, and 17, 18*a*, 19*a* and 19*b* in the southern section, but some useful information may be derived by studying the velocity differences calculated in various directions between these stations. The greatest values were found between Stations 19*a* and 19*b*, where the velocity at 350 metres was about 9 miles per day less than at the surface. That the Atlantic stream did not cross this line vertically is shown by the considerable values found between Stations 13*a* and 19*b*, where a falling-off in velocity of three miles in 24 hours was shown at 350 metres depth. All things considered, the direction of flow then seems to have been nearly the same as in July of the previous year and the velocity a few miles per day greater.

In the southern section of the channel, only one station (19*a*) was worked during the following August, but results have been calculated from this point across channel in all possible directions, and in addition the usual calculations have been made between stations along the northern section. The hydrodynamical conditions indicate the usual strong Atlantic flow on the eastward side, where the velocity difference then amounted to 20 cm. per sec., at a depth of 500 metres. In its passage across channel, however, the current apparently followed a winding course, the density distribution in the region of stations 15*a* and 15*b* indicating that the direction of flow was there a south-easterly one. This is quite in accordance with the conditions shown in the hydrographical section for that month, when the surface salinity in the centre of the channel, on account of a southward movement of Norwegian sea water, fell below 35 per mille. The opposing force of such a movement would naturally tend to displace southwards the Atlantic water in the centre of the channel, so that its flow would at that point be a south-easterly one. The surface velocity in the eastern part af the section seems, at that time, to have been some 12–14 miles per 24 hours.

Both sections of the channel were worked during November 1908, and the velocity differences have been calculated between the stations in all possible ways. As stated when considering the conditions from a hydrographical point of view, the Atlantic Stream then entered the channel south of the Faeroes and preserved an almost easterly course towards the central regions. This accounts for the small differences of velocity found between stations in the westerly area, where the density conditions then indicated a direction of flow nearly parallel to the sections. Beyond the centre of the channel, as shown by the high values obtained between stations 19*a* and 20*a*, the current assumed a north-easterly direction and crossed the region between stations 19*b* and 20*a* nearly at right angles. The winding course assumed in the northern part of the section during the previous August was again adhered to, the direction of flow being south-easterly in the centre of the channel and north-easterly near Shetland. As the hydrographical section shows, Norwegian Sea water was once again in evidence in the central regions, where the surface salinity fell below 35 per mille. Within the main Atlantic flow in the eastern side of the channel the velocity showed only a small decrease to a depth of 100 metres, but beyond that point the falling-off was much more rapid. Assuming, again, that the water at 600 metres was more or less motionless, and that the Atlantic Stream crossed the region from 13*a*–14*a* in a vertical direction, the rate of flow of the surface waters must at that time have amounted to at least 17 miles per day, some four miles per day greater than in the previous August.

SUMMARY.

The Scheme of International Hydrographic Research has now been in progress for upwards of six years, and much valuable information has been acquired from the observations made simultaneously over the different areas and repeated at the same fixed stations during that time. Several general rules may now be deduced regarding the distribution and variation of temperature and salinity, and these will in future be of assistance in determining whether results obtained at a certain place and time ought to be considered as of normal value or not.

Over a considerable part of the North Sea, the tidal action is powerful enough to effect a thorough mixing of the waters from surface to bottom, this being more particularly the case in the southern regions where the depths are but slight. Thus in future from observations taken over this area from the surface alone, it will be possible to determine the temperature and salinity of the whole water-column with an exactness sufficient for most purposes. Over the northern part of the North Sea, however, the conditions are entirely different, and only in the colder months, when the action of convection currents is most powerful, does any uniformity whatever exist in the surface to bottom distribution.

Over the North Sea area, the temperature in summer decreases from the shore outwards to the open sea, while in winter the reverse conditions hold good. During the summer months, the warmest water (15°–18°) occurs along the Belgian and Dutch coasts and the coldest in the deep channel off Norway, while in winter the coldest water (2°–3°) is found along the Danish coast, and the warmest (7°) usually between Scotland and Shetland. The greatest annual surface variation of temperature occurs along the Belgian, Dutch and German coasts, where it amounts to about 13°, while between Scotland and Shetland it is some 9° less. In the deeper layers over the northern area of the North Sea the corresponding value is only 1°, while the smallest variation of all takes place in the deepest regions of the Skagerrack, where the temperature only changes by two-tenths of a degree throughout the entire year.

As regards the distribution of salinity, the strong tidal currents cause so intense a mixing along the Scottish, English, Belgian and Dutch coasts that water of less than 33 per mille is rarely found more than a few miles from shore. Over the North Sea area the variations of salinity are less in the deeper layers than in the surface, and the greatest mean deviation from the average takes place in the regions of lowest salinity. Thus near the Continental coast, where there is a considerable proportion of fresh water, large changes of salinity take place from time to time, while in the northern area of the North Sea, which is always largely flooded by salt Atlantic water, the variation rarely exceeds two-tenths per mille, within the North Sea, the lines of equal salinity usually follow the shape of the coast, and except in the inshore waters, the salinity is usually confined within the limits of 34 and 35·3 per mille. Such small changes of salinity can hardly of themselves be of importance in regard to the occurrence and wanderings of the various food-fishes, but are mainly of interest as a guide to the directions of the currents and the movements of the waters.

With respect to the hydrographic changes which take place from time to time over the North Sea and surrounding waters, much information has been acquired during the time the investigations have been in progress. Large volumes of Atlantic water are normally streaming northwards as a surface current through the Faeroe-Shetland Channel into the Norwegian Sea. Comparatively little Atlantic water enters the Norwegian Sea between the Faeroes and Iceland on account of the opposing force of the East Icelandic Polar Current, which normally flows southwards along the east coast of Iceland into the regions north of the Faeroes. Only under exceptional conditions, however, such as must have existed in the early part of 1908, can Polar water extend so far southwards as to enter the regions of the channel, the Atlantic flow being usually powerful enough to prevent this taking place. The deeper layers north of the Wyville-Thomson Ridge are normally flooded by cold water of 34·9 per mille, water which is in direct connection with the bottom area of the Norwegian Sea. Occasionally, at least in the southern parts of the channel, these bottom layers are displaced by salter and warmer water, showing that marked changes may take place even at the greatest depths.

Between the Faeroes and Fair Isle, the centre of the Atlantic Stream is situated between 3° and 5° W. longitude, where the mean annual temperature is 9·5° and the mean annual salinity 35·29 per mille. Within the regions of the channel, its direction of flow varies from north-east to east and the velocity of the surface waters appears to average about 14 miles in 24 hours. During its passage across channel, the Atlantic Stream throws off branches of salt water which enter the North Sea round the north and south of Shetland, and this latter inflow, at least, appears to be subject to seasonal variation. A scanty winter salt-water distribution is normally flooded by a more vigorous inflow during early spring, increasing to a maximum in the beginning of summer. A gradual decrease on the approach of the following winter subsequently completes the cycle of changes for the year. Exceptions to these apparently normal conditions have been shown on three occasions since the start of the investigations in August, 1902. During the winter of 1905–6, an unusually powerful Atlantic inflow took place; during the summer of 1907, the period of maximum inflow was unduly delayed; and throughout the whole of 1908, the Atlantic inflow was very scanty, more particularly during the early part of the year.

The greater proportion of the Atlantic water entering the northern area of the North Sea bends eastward before reaching the 57th parallel, and, after throwing out an offshoot which enters the Skagerrack as an undercurrent, is carried back northwards again along with a certain quantity of Baltic water and North Sea water. This rotational movement, due to the configuration of the bottom, gives rise to a cold deep-water area, an area with a great temperature phase-delay over which the maximum value in the bottom layers is not reached till near the close of the year. A fresh-water current continually streams northwards along the Norwegian coast, being exclusively confined to the in-shore regions during the winter months but extending in spring and summer far out to sea as a thin surface layer. Similar off-shore movements take place from the Scottish coast during the summer months, and as these currents carry out to sea large quantities of pelagic eggs and larvæ, the study of their seasonal changes is of great importance in connection with fishery problems.

While the investigations have been in progress, changes have several times taken place which must be regarded as unperiodical ones, not likely to occur again at any specified time. Such conditions existed throughout the winter of 1905–6, when an extensive salt-water inflow took place into the North Sea, this unusual occurrence being apparently due to the abnormal conditions then existing in the waters of the North Atlantic. The southward movement of Norwegian Sea water, which took place during the early part of 1908, must be similarly regarded, this being the only occasion since the investigations were started on which the Atlantic inflow south of Shetland has been entirely suspended. Throughout the whole of that year, in fact, the distribution of Atlantic water was particularly scanty over the North Sea area, and the conditions then existing must accordingly be looked on as abnormal in character and as unlikely to occur again until circumstances favourable to their development once more arise.

STATION SC. 2.

Latitude, 58° 36′ N.; Longitude, 1° 46′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/₀₀.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/₀₀.	σt.	v—v′.	e—e′.
	12th February, 1907.					10th May, 1907.					6th August, 1907.				
0	6·05	35·08	27·65	47	0	7·45	35·22	27·56	55	0	11·55	35·25	26·85	117	0
10	6·40	35·02	27·52	55	510	7·45	35·15	27·50	60	575	11·00	35·21	26·96	110	1135
20	6 40	35·00	27·52	57	1070	7·45	35·13	27·48	62	1185	10·72	35·21	27·01	106	2215
30	6·40	35·00	27·52	57	1640	7·38	35·17	27·51	58	1785	9·72	35·21	27·18	90	3195
40	—	—	—	—	—	7·08	35·21	27·60	52	2335	9·46	35·21	27·22	86	4075
50	6·42	35·00	27·52	57	2780	—	—	—	—	—	—	—	—	—	—
60	—	—	—	—	—	7·04	35·20	27·59	52	3375	9·18	35·25	27·29	78	5715
70	6·44	35·04	27·55	55	3900	—	—	—	—	—	—	—	—	—	—
80	—	—	—	—	—	6·99	35·20	27·60	52	4415	9·00	35·26	27·34	76	7255
92	6·49	35·02	27·52	59	5154	—	—	—	—	—	—	—	—	—	—
100	—	—	—	—	—	—	—	—	—	—	8·72	35·28	27·40	71	8725
105	—	—	—	—	—	6·92	35·24	27·64	62	5840	—	—	—	—	—
	21st August, 1907.					15th November, 1907.					11th March, 1908.				
0	10·45	35·05	26·92	114	0	9·55	35·12	27·15	93	0	6·35	34·79	27·35	72	0
10	10·51	35·03	26·91	116	1150	9·68	35·07	27·07	99	960	6·41	34·70	27·29	80	760
20	10·41	broken		—	—	9·68	35·07	27·07	99	1950	—	—	—	—	—
30	10·01	35·14	27·08	100	3310	—	—	—	—	—	6·41	34·70	27·20	80	2360
40	9·92	35·14	27·10	99	4305	9·68	35·07	27·07	100	3940	—	—	—	—	—
60	9·90	35·16	27·11	97	6265	—	—	—	—	—	—	—	—	—	—
70	—	—	—	—	—	—	—	—	—	—	6·41	34·74	27·32	78	5520
80	9·80	35·21	27·17	93	8165	9·69	35·07	27·07	101	7960	—	—	—	—	—
90	—	—	—	—	—	—	—	—	—	—	6·41	34·74	27·32	79	7090
100	9·80	35·25	27·19	90	9995	9·69	35·07	27·07	101	9980	—	—	—	—	—
	4th June, 1908.					20th June, 1908.					6th September, 1908.				
0	9·65	34·87	26·93	114	0	9·25	34·96	27·06	101	0	11·85	35·23	26·89	124	0
10	9·40	34·83	26·94	113	1135	9·34	34·96	27·04	103	1020	11·62	35·19	26·82	123	1235
20	7·99	34·92	27·23	84	2120	9·30	34·96	27·05	102	2045	10·64	35·19	27·00	105	2375
30	7·09	35·01	27·44	66	2870	7·74	35·07	27·39	70	2905	10·40	35·19	27·05	102	3410
50	7·08	35·10	27·51	60	4130	7·12	35·10	27·50	61	4215	9·99	35·19	27·12	96	5390
70	6·90	35·10	27·64	57	5300	7·01	35·10	27·52	59	5415	8·51	35·19	27·36	73	7080
90	6·83	35·10	27·65	57	6440	7·01	35·10	27·52	60	6605	—	—	—	—	—
105	—	—	—	—	—	—	—	—	—	—	8·51	35·19	27·36	74	9653
110	6·73	35·10	27·66	55	7560	7·00	35·10	27·52	60	7685	—	—	—	—	—
	15th September, 1908.					5th November, 1908.					—				
0	10·90	35·10	26·89	117	—	10·45	34·97	26·87	—	—	—	—	—	—	—
10	10·92	35·08	26·87	119	—	10·64	34·97	26·83	—	—	—	—	—	—	—
20	10·92	35·08	26·87	119	—	10·68	34·97	26·84	—	—	—	—	—	—	—
30	10·82	35·08	26·89	117	—	10·68	34·97	26·84	—	—	—	—	—	—	—
50	10·48	35·16	27·00	107	—	10·70	35·03	26·88	—	—	—	—	—	—	—
70	10·22	35·19	27·08	101	—	10·70	35·03	26·88	—	—	—	—	—	—	—
90	10·22	35·19	27·08	101	—	—	—	—	—	—	—	—	—	—	—
100	—	—	—	—	—	10·61	35·10	26·95	—	—	—	—	—	—	—

Station Sc. 3.

Latitude, 59° 10′ N.; Longitude, 1° 27′ W.

Depth (Metres).	Temp. °C.	S.°/∞	σt	v—v′.	e—e′.	Temp. °C.	S.°/∞	σt	v—v′.	e—e′.	Temp. °C.	S.°/∞	σt	v—v′.	e—e′.
	13th February, 1907.					10th May, 1907.					6th August, 1907.				
0	6·65	35·27	27·71	40	0	7·45	35·28	27·60	51	0	12·35	35·19	26·69	136	0
10	6·79	35·24	27·65	44	420	7·44	35·19	27·52	57	540	10·21	35·19	27·08	99	1185
20	6·81	35·20	27·62	47	875	7·44	35·20	27·53	56	1105	9·82	35·23	27·18	89	2125
30	6·81	35·22	27·64	46	1340	7·42	35·21	27·55	56	1665	9·72	35·23	27·19	88	3010
40	6·82	35·17	27·59	51	1825	7·40	35·21	27·55	57	2225	9·72	35·23	27·19	88	3895
60	6·84	35·17	27·59	51	2845	7·36	35·26	27·60	52	3415	9·72	35·23	27·19	88	5685
83	6·86	35·15	27·57	54	4315	7·35	35·26	27·60	53	4885	9·75	35·23	27·19	88	8191
	15th November, 1907.					12th March, 1908.					19th June, 1908.				
0	9·55	35·12	27·15	93	0	6·55	34·83	27·37	72	0	8·65	35·08	27·25	82	0
10	9·82	35·03	27·02	104	985	6·61	34·76	27·30	77	745	8·49	35·10	27·29	78	800
20	9·82	35·03	27·02	104	2025	6·62	34·76	27·30	77	1522	8·28	35·17	27·38	70	1540
30	—	—	—	—	—	—	—	—	—	—	7·99	35·17	27·43	66	2220
40	9·82	35·05	27·03	103	4095	—	—	—	—	—	—	—	—	—	—
50	—	—	—	—	—	6·62	34·76	27·30	78	3847	7·79	35·14	27·44	66	3540
70	—	—	—	—	—	—	—	—	—	—	7·65	35·14	27·46	65	4850
80	9·79	35·07	27·05	102	8195	6·62	34·76	27·30	79	6202	—	—	—	—	—
100	9·79	35·07	27·05	102	10235	6·63	34·76	27·30	79	7782	7·70	35·14	27·45	66	6815
	7th August, 1907.					15th September, 1908.					5th November, 1908.				
0	11·45	35·19	25·85	120	0	10·85	35·10	26·91	116	0	10·45	34·88	26·79	—	—
10	11·19	35·14	26·87	118	1190	10·71	35·10	26·93	114	1150	10·80	34·88	26·74	—	—
20	10·91	35·14	26·91	114	2350	10·71	35·10	26·93	114	2290	10·80	34·92	26·76	—	—
30	10·38	35·14	27·01	105	3445	10·71	35·10	26·93	114	3130	10·85	34·92	26·76	—	—
50	9·62	35·14	27·15	94	5435	10·71	15·14	26·96	112	5690	10·90	34·97	26·80	—	—
70	9·49	35·14	27·16	93	7305	10·72	35·10	26·93	116	7970	10·85	34·97	26·81	—	—
80	—	—	—	—	—	10·72	35·10	26·93	116	9130	—	—	—	—	—
100	—	—	—	—	—	—	—	—	—	—	10·84	34·97	26·81	—	—
103	9·11	35·19	27·27	83	10209	—	—	—	—	—	—	—	—	—	—

Station Sc. 4.

Latitude, 59° 26′ N.; Longitude, 1° 20′ W.

Depth (Metres).	Temp. °C.	S.°/∞	σt	v—v′.	e—e′.	Temp. °C.	S.°/∞	σt	v—v′.	e—e′.	Temp. °C.	S.°/∞	σt	v—v′.	e—e′.
	13th February, 1907.					10th May, 1907.					6th August, 1907.				
0	6·85	35·31	27·76	40	0	7·35	35·28	27·61	49	0	10·75	35·19	26·99	107	0
10	7·08	35·29	27·66	45	425	7·13	35·28	27·64	47	480	9·71	35·23	27·20	87	970
20	7·08	35·29	27·66	45	875	7·13	35·29	27·65	46	945	9·62	35·23	27·22	84	1825
30	7·08	35·29	27·66	45	1325	7·13	35·30	27·66	46	1405	9·62	35·21	27·21	86	2675
40	—	—	—	—	—	7·13	35·26	27·63	49	1880	—	—	—	—	—
50	7·08	35·27	27·65	48	2255	—	—	—	—	—	9·62	35·25	27·23	85	4375
60	—	—	—	—	—	7·13	35·26	27·63	49	2860	—	—	—	—	—
70	7·09	35·31	27·68	46	3195	—	—	—	—	—	9·62	35·19	27·19	90	6125
86	—	—	—	—	—	7·13	35·28	27·64	49	4134	—	—	—	—	—
90	7·10	35·27	27·65	48	4135	—	—	—	—	—	—	—	—	—	—
94	—	—	—	—	—	—	—	—	—	—	9·57	35·26	27·25	86	8237
	16th November, 1907.					12th March, 1908.					4th June, 1908.				
0	9·75	35·12	27·10	96	0	6·55	34·76	27·31	76	0	8·35	34·96	27·21	87	0
10	9·72	35·08	27·08	98	970	6·59	34·74	27·29	79	775	7·62	35·01	27·36	73	800
20	9·72	35·08	27·08	98	1950	6·59	34·74	27·29	79	1565	7·58	35·01	27·37	72	1525
30	—	—	—	—	—	—	—	—	—	—	7·54	35·07	27·41	67	2220
40	9·72	35·08	27·08	99	3920	6·59	34·74	27·29	80	3155	7·50	35·12	27·46	64	2875
60	9·72	35·08	27·08	99	5900	—	—	—	—	—	7·49	35·14	27·48	63	4145
70	—	—	—	—	—	6·58	34·74	27·29	80	5555	—	—	—	—	—
80	9·73	35·08	27·08	100	7890	—	—	—	—	—	7·43	35·17	27·52	61	5385
90	—	—	—	—	—	6·58	37·74	27·29	81	7165	—	—	—	—	—
100	—	—	—	—	—	—	—	—	—	—	7·28	35·17	27·54	59	6585

Station Sc. 4—*continued.*

Latitude, 59° 26′ N.; Longitude, 1° 20′ W.—*continued.*

Depth (Metres).	Temp. °C.	S.‰	σt	v—v′.	e—e′.	Temp. °C.	S.‰	σ	v—v′.	e—e′.	Temp. °C.	S.‰	σt	v—v′.	e—e′.
	19th June, 1908.					7th August, 1908.					15th September, 1908.				
0	9·05	35·10	27·21	87	0	18·85	35·91	26·99	108	0	11·05	35·19	26·93	112	0
10	8·44	35·12	27·33	76	815	10·80	35·19	26·98	109	1085	10·78	35·19	26·98	108	1100
20	8·32	35·12	27·34	75	1570	10·18	35·19	27·09	98	2120	10·60	35·19	27·01	106	2170
30	8·29	35·12	27·34	74	2315	9·99	35·19	27·12	95	3085	10·58	35·19	27·02	106	3230
50	8·22	35·12	27·36	74	3795	9·72	35·19	27·17	92	4955	10·52	35·19	27·03	106	5350
70	8·15	35·12	27·37	74	5275	9·59	35·19	27·19	90	6775	10·51	35·19	27·03	107	7480
88	—	—	—	—	—	—	—	—	—	—	10·51	35·26	27·09	100	9343
98	7·43	35·19	27·53	59	7137	—	—	—	—	—	—	—	—	—	—
100	—	—	—	—	—	8·59	35·19	27·35	74	9235	—	—	—	—	—
	5th November, 1908.					—					—				
0	10·55	34·90	26·80	—	—	—	—	—	—	—	—	—	—	—	—
10	10·70	34·90	26·77	—	—	—	—	—	—	—	—	—	—	—	—
20	10·70	34·94	26·80	—	—	—	—	—	—	—	—	—	—	—	—
30	10·62	34·96	26·82	—	—	—	—	—	—	—	—	—	—	—	—
50	10·65	35·01	26·87	—	—	—	—	—	—	—	—	—	—	—	—
70	10·60	35·07	26·92	—	—	—	—	—	—	—	—	—	—	—	—
100	10·53	35·08	26·94	—	—	—	—	—	—	—	—	—	—	—	—

Station Sc. 5.

Latitude, 59° 40′ N.; Longitude, 1° 14′ W.

	13th February, 1907.					10th May, 1907.					4th July, 1907.				
0	6·15	35·23	27·74	37	0	7·45	35·22	27·56	55	0	9·15	35·30	27·34	74	0
10	6·33	35·23	27·71	39	380	7·42	35·24	27·57	54	545	8·92	35·30	27·39	69	715
20	6·39	35·23	27·69	40	775	7·22	35·20	27·57	53	1080	8·91	35·30	27·39	69	1405
30	6·39	35·25	27·70	38	1165	7·00	35·22	27·62	49	1590	8·58	35·30	27·43	65	2075
40	6·39	35·27	27·73	37	1540	—	—	—	—	—	8·58	35·30	27·43	66	2730
50	—	—	—	—	—	6·90	35·25	27·66	46	2540	—	—	—	—	—
60	6·39	35·29	27·74	36	2270	—	—	—	—	—	8·52	35·30	27·45	65	4060
70	—	—	—	—	—	6·89	35·22	27·65	47	3470	—	—	—	—	—
80	6·39	35·24	27·70	40	3030	—	—	—	—	—	8·42	35·32	27·48	64	5350
97	—	—	—	—	—	6·89	35·22	27·65	48	4753	—	—	—	—	—
103	6·39	35·24	27·70	40	3950	—	—	—	—	—	8·21	35·34	27·53	59	6765
	7th August, 1907.					16th November, 1907.					12th March, 1908.				
0	10·55	35·26	27·09	99	0	9·55	35·17	27·20	90	0	6·85	34·78	27·29	79	0
10	10·31	35·26	27·13	95	970	9·50	35·17	27·20	89	895	6·88	34·79	27·30	79	790
20	9·94	35·26	27·20	89	1900	9·50	35·17	27·20	89	1785	6·90	34·79	27·29	79	1580
30	9·74	35·26	27·22	85	2770	—	—	—	—	—	—	—	—	—	—
40	9·74	35·26	27·22	86	3625	9·50	35·17	27·20	90	3575	6·90	34·37	27·29	80	3170
60	9·68	35·26	27·23	85	5335	—	—	—	—	—	—	—	—	—	—
70	—	—	—	—	—	9·50	35·17	27·20	90	6275	6·88	34·81	27·31	80	5570
80	9·64	35·26	27·24	86	7045	—	—	—	—	—	—	—	—	—	—
90	—	—	—	—	—	9·51	35·17	27·20	91	8085	6·85	34·81	27·32	80	7170
100	9·59	35·26	27·25	85	8755	—	—	—	—	—	—	—	—	—	—
	4th June, 1908.					19th June, 1208.					7th August, 1908.				
0	8·75	35·07	27·23	84	0	8·95	35·17	27·29	80	0	11·55	35·19	26·85	121	0
10	8·42	35·23	27·41	68	760	8·22	35·17	27·40	69	745	11·65	35·23	26·85	120	1205
20	7 81	35·21	27·49	60	1400	8·21	35·17	27·40	69	1435	10·44	35·23	27·08	100	2305
30	7·42	35·19	27·53	57	1485	8·20	35·19	27·41	67	2115	10·21	35·21	27·10	97	3290
50	7·15	35·16	27·54	56	3115	8·19	35·19	27·41	68	3465	10·02	35·21	27·14	95	5210
70	6·89	35·21	27·60	50	4175	8·19	35·19	27·41	69	4835	9·31	35·23	27·26	83	6990
90	6·83	35·26	27·66	46	5155	—	—	—	—	—	—	—	—	—	—
98	—	—	—	—	—	8·19	35·21	27·43	67	6739	8·09	35·23	27·45	65	9062
108	6·81	35·26	27·66	46	5963	—	—	—	—	—	—	—	—	—	—

STATION SC. 5—*continued.*

Latitude, 59° 40′ N. ; Longitude, 1° 14′ W.—*continued.*

Depth (Metres).	Temp. °C.	S.°/°°	σt	v—v′.	e—e′.	Temp. °C.	S.°/°°	σt	v—v′.	e—e′.	Temp. °C.	S.°/°°	σt	v—v′.	e—e′.
	15th September, 1908.					5th November, 1908.					—				
0	10·85	35·16	26·94	112	0	10·25	34·99	26·92	—	—	—	—	—	—	—
10	10·88	35·16	26·95	112	1120	10·44	35·01	26·91	—	—	—	—	—	—	—
20	10·88	35·14	26·95	113	2245	10·46	35·01	26·90	—	—	—	—	—	—	—
30	10·88	35·14	26·95	113	3375	10·51	35·10	26·96	—	—	—	—	—	—	—
50	10·88	35·14	26·95	114	5645	10·22	35·19	27·08	—	—	—	—	—	—	—
70	10·89	35·14	26·95	115	7935	9·71	35·19	27·17	—	—	—	—	—	—	—
90	10·89	35·17	26·95	113	10215	—	—	—	—	—	—	—	—	—	—
100	—	—	—	—	—	9·41	35·19	27·22	—	—	—	—	—	—	—

STATION SC. 5*a*.

Latitude, 60° 5′ N. ; Longitude, 0° 48′ W.

Depth (Metres).	Temp. °C.	S.°/°°	σt	v—v′.	e—e′.	Temp. °C.	S.°/°°	σt	v—v′.	e—e′.	Temp. °C.	S.°/°°	σt	v—v′.	e—e′.
	24th February, 1907.					10th May, 1907.					7th August, 1907.				
0	6·15	35·27	27·78	34	0	7·45	35·26	27·59	52	0	11·85	35·28	26·24	119	0
10	6·29	35·22	27·71	39	365	7·56	35·24	27·55	55	535	11·20	35·28	26·97	109	1140
20	6·29	35·25	27·72	37	745	7·55	35·22	27·54	57	1095	10·29	35·28	27·14	94	2155
30	6·29	35·25	27·72	37	1115	7·55	35·26	27·56	54	1650	9·92	35·28	27·21	87	3965
40	6·28	35·28	27·76	37	1485	—	—	—	—	—	—	—	—	—	—
50	—	—	—	—	—	7·22	35·26	27·62	50	2690	9·41	35·28	27·29	81	5645
60	6·28	35·26	27·75	38	2235	—	—	—	—	—	—	—	—	—	—
70	—	—	—	—	—	7·09	35·26	27·63	48	3670	8·89	35·28	27·37	71	7165
80	6·26	35·26	27·75	39	3005	—	—	—	—	—	—	—	—	—	—
90	—	—	—	—	—	7·05	35·24	27·62	50	4650	8·70	35·28	27·41	69	8565
100	6·20	35·25	27·73	38	3775	—	—	—	—	—	—	—	—	—	—
110	—	—	—	—	—	7·05	35·22	27·62	52	5670	8·39	35·28	27·45	66	9915
120	6·05	35·23	27·74	38	4535	—	—	—	—	—	—	—	—	—	—
	25th November, 1907.					12th March, 1908.					15th September, 1908.				
0	8·85	35·21	27·33	75	0	7·05	34·87	27·33	76	0	11·05	35·12	26·88	118	0
10	9·09	35·14	27·23	85	800	7·21	34·87	27·31	77	765	11·15	35·14	26·88	118	1180
20	9·09	35·14	27·23	85	1650	7·25	34·88	27·31	78	1540	11·10	35·14	26·89	117	2355
30	—	—	—	—	—	—	—	—	—	—	10·90	35·14	26·93	114	3510
40	9·09	35·14	27·23	86	3360	7·25	34·88	27·31	79	3110	—	—	—	—	—
50	—	—	—	—	—	—	—	—	—	—	10·68	35·19	27·00	107	5720
60	9·09	35·14	27·23	86	5080	—	—	—	—	—	—	—	—	—	—
70	—	—	—	—	—	—	—	—	—	—	10·68	35·14	26·96	111	7903
80	9·10	35·14	27·23	87	6810	7·25	34·88	27·31	80	6290	—	—	—	—	—
100	9·10	35·14	27·23	87	8550	7·26	34·88	27·31	80	7890	10·06	35·14	27·07	102	11095
110	—	—	—	—	—	—	—	—	—	—	9·81	35·17	27·14	96	12085
	5th November, 1908.					—					—				
0	10·00	35·23	27·15	—	—	—	—	—	—	—	—	—	—	—	—
10	10·00	35·23	27·15	—	—	—	—	—	—	—	—	—	—	—	—
20	10·00	35·23	27·15	—	—	—	—	—	—	—	—	—	—	—	—
30	10·00	35·23	27·15	—	—	—	—	—	—	—	—	—	—	—	—
50	10·00	35·23	27·15	—	—	—	—	—	—	—	—	—	—	—	—
70	10·00	35·23	27·15	—	—	—	—	—	—	—	—	—	—	—	—
100	9·96	35·23	27·16	—	—	—	—	—	—	—	—	—	—	—	—
110	9·96	35·23	27·16	—	—	—	—	—	—	—	—	—	—	—	—

STATION SC. 5*b*.

Latitude, 60° 31′ N. ; Longitude, 0° 35′ W.

Depth (Metres).	Temp. °C.	S.°/°°	σt	v—v′.	e—e′.	Temp. °C.	S.°/°°	σt	v—v′.	e—e′.	Temp. °C.	S.°/°°	σt	v—v′.	e—e′.
	13th May, 1907.					25th November, 1907.					13th March, 1908.				
0	7·85	35·30	27·56	54	0	8·85	35·12	27·25	82	0	6·35	34·79	27·36	72	0
10	7·92	35·28	27·52	57	555	9·16	35·12	27·20	88	850	6·52	34·76	27·31	77	745
20	7·88	35·26	27·52	57	1125	9·18	35·12	27·20	88	1730	6·56	34·76	27·30	77	1515
30	7·78	35·26	27·53	56	1690	—	—	—	—	—	—	—	—	—	—
40	7·69	35·28	27·55	55	2240	9·18	35·21	27·28	82	3430	6·56	34·76	27·30	78	3065
60	7·62	35·22	27·53	58	3370	9·18	35·12	27·20	89	5140	—	—	—	—	—
80	7·59	35·26	27·55	56	4510	9·20	35·12	27·20	90	6930	6·56	34·78	27·33	78	6185
100	7·53	35·24	27·55	57	5640	9·20	35·16	27·23	86	8690	6·57	34·38	27·33	78	7745
135	—	—	—	—	—	—	—	—	—	—	6·57	34·78	27·33	78	10475
140	7·51	35·23	27·55	58	7940	9·20	35·16	27·23	87	12150	—	—	—	—	—

STATION SC. 5*b*—*continued.*

Latitude, 60° 31′ N.; Longitude, 0° 35′ W.—*continued.*

Depth (Metres).	Temp. °C.	S.°/∞	σt	v—v′.	e—e′.	Temp. °C.	S.°/∞	σt	v—v′.	e—e′.	Temp. °C.	S.°/∞	σt	v—v′.	e—e′.
	16th September, 1908.					6th November, 1908.					—				
0	10·60	35·14	26·98	109	0	10·00	35·28	27·19	—	—	—	—	—	—	—
10	10·50	35·14	27·00	108	1085	10·18	35·23	27·12	—	—	—	—	—	—	—
20	10·45	35·14	27·00	107	2160	10·18	35·23	27·12	—	—	—	—	—	—	—
30	10·28	35·14	27·03	104	3215	10·18	35·23	27·12	—	—	—	—	—	—	—
50	10·12	35·14	27·06	103	5285	10·18	35·23	27·12	—	—	—	—	—	—	—
70	10·05	35·16	27·08	100	7315	10·18	35·23	27·12	—	—	—	—	—	—	—
100	10·06	35·16	27·08	100	10315	10·19	35·23	27·12	—	—	—	—	—	—	—
130	10·07	35·19	27·10	99	13300	10·19	35·23	27·12	—	—	—	—	—	—	—

STATION SC. 5*c*.

Latitude, 61° 13′ N.; Longitude, 0° 5′ E.

Depth (Metres).	Temp. °C.	S.°/∞	σt	v—v′.	e—e′.	Temp. °C.	S.°/∞	σt	v—v′.	e—e′.	Temp. °C.	S.°/∞	σt	v—v′.	e—e′.
	9th July, 1908.					—					—				
0	11·25	35·32	26·99	107	0	—	—	—	—	—	—	—	—	—	—
10	11·20	35·28	26·97	108	1075	—	—	—	—	—	—	—	—	—	—
20	11·10	35·28	26·99	107	2150	—	—	—	—	—	—	—	—	—	—
30	10·84	35·30	27·07	101	3190	—	—	—	—	—	—	—	—	—	—
50	9·10	35·32	27·36	72	4920	—	—	—	—	—	—	—	—	—	—
70	8·91	35·32	27·39	70	6340	—	—	—	—	—	—	—	—	—	—
100	8·41	35·30	27·47	65	8365	—	—	—	—	—	—	—	—	—	—
150	8·14	35·28	27·49	63	11565	—	—	—	—	—	—	—	—	—	—

STATION SC. 6.

Latitude, 60° 35′ N.; Longitude, 0° 29′ E.

Depth (Metres).	Temp. °C.	S.°/∞	σt	v—v′.	e—e′.	Temp. °C.	S.°/∞	σt	v—v′.	e—e′.	Temp. °C.	S.°/∞	σt	v—v′.	e—e′.
	25th May, 1907.					28th November, 1907.					15th March, 1908.				
0	8·35	35·32	27·49	60	0	8·95	35·30	27·39	70	0	6·85	35·25	27·65	45	0
10	8·15	35·30	27·51	59	595	9·11	35·30	27·36	73	715	7·12	35·21	27·59	51	480
20	7·92	35·29	27·53	56	1170	9·10	35·30	27·36	73	1445	—	—	—	—	—
30	7·70	35·30	27·57	53	1715	—	—	—	—	—	7·15	35·17	27·56	54	1130
40	7·66	35·30	27·58	53	2245	9·10	35·30	27·36	74	2915	—	—	—	—	—
60	7·65	35·30	27·58	52	3295	9·08	35·32	27·37	73	4385	7·15	35·17	27·56	55	2765
80	7·51	35·30	27·61	52	4335	9·02	35·32	27·38	73	5845	7·21	35·17	27·55	57	3885
100	7·21	35·28	27·63	49	5345	9·00	35·32	27·38	72	7295	7·31	35·23	27·57	55	5005
140	—	—	—	—	—	9·00	35·34	27·40	71	10275	7·33	35·25	27·58	54	7185
148	6·95	35·35	27·73	51	7745	—	—	—	—	—	—	—	—	—	—

Depth (Metres).	Temp. °C.	S.°/∞	σt	v—v′.	e—e′.	Temp. °C.	S.°/∞	σt	v—v′.	e—e′.	Temp. °C.	S.°/∞	σt	v—v′.	e—e′.
	5th July, 1908.					25th September, 1908.					—				
0	11·35	35·30	26·96	109	0	11·05	35·12	26·88	118	0	—	—	—	—	—
10	11·29	35·26	26·94	110	1095	11·08	35·14	26·89	117	1175	—	—	—	—	—
20	11·28	35·26	26·94	110	2195	11·00	35·17	26·93	113	2325	—	—	—	—	—
30	10·05	35·28	27·18	89	3190	11·00	35·19	26·94	111	3445	—	—	—	—	—
50	8·56	35·28	27·41	67	4750	10·70	35·19	26·99	108	5635	—	—	—	—	—
70	7·90	35·25	27·49	61	6030	8·75	35·21	27·34	76	7475	—	—	—	—	—
100	7·40	35·25	27·57	55	7770	7·69	35·21	27·50	61	9530	—	—	—	—	—
130	7·01	35·25	27·63	50	9345	7·23	35·21	27·58	57	11300	—	—	—	—	—

STATION SC. 6*a*.

Latitude, 60° 4′ N.; Longitude. 0° 33′ E.

Depth (Metres).	Temp. °C.	S.°/∞	σt	v—v′.	e—e′.	Temp. °C.	S.°/∞	σt	v—v′.	e—e′.	Temp. °C.	S.°/∞	σt	v—v′.	e—e′.
	25th May, 1907.					1st September, 1907.					28th November, 1907.				
0	8·05	35·26	27·50	61	0	10·85	35·03	26·85	120	0	8·05	35·21	27·45	64	0
10	7·65	35·26	27·54	54	575	10·98	34·96	26·76	128	1240	8·39	35·21	27·40	69	665
20	7·28	35·30	27·63	47	1080	10·98	34·97	26·78	127	2515	8·39	35·23	27·41	67	1345
30	7·24	35·25	27·59	52	1575	10·98	35·01	26·81	125	3775	—	—	—	—	—
40	7·24	35·29	27·63	49	2080	8·32	35·30	27·48	64	4720	8·41	35·23	27·41	68	2695
60	7·15	35·28	27·64	48	3050	7·58	35·30	27·59	52	5880	8·41	35·23	27·41	68	4055
80	6·70	35·23	27·66	46	3990	7·37	35·30	27·62	50	6900	8·43	35·23	27·41	69	5425
100	—	—	—	—	—	7·07	35·35	27·71	42	7820	8·29	35·30	27·48	64	6755
114	6·61	35·26	27·70	43	5503	—	—	—	—	—	—	—	—	—	—
115	—	—	—	—	—	7·03	35·35	27·72	42	9290	—	—	—	—	—

STATION SC. 6a—*continued.*

Latitude, 60° 4′ N. ; Longitude, 0° 33′ E.—*continued.*

Depth (Metres).	Temp. °C.	S.‰	σt	v—v′.	e—e′.	Temp. °C.	S.‰	σt	v—v′.	e—e′.	Temp. °C.	S.‰	σt	v—v′.	e—e′.
	15th March, 1908.					5th July, 1908.					25th September, 1908.				
0	6·45	35·25	27·70	38	0	11·05	35·25	26·97	108	0	11·60	34·63	26·32	164	0
10	6·64	35·10	27·58	52	450	11·11	35·26	26·98	108	1080	11·56	34·65	26·39	162	1630
20	—	—	—	—	—	11·11	35·19	26·92	113	2185	11·40	34·96	26·68	136	3120
30	6·68	35·16	27·58	47	1440	10·70	35·19	26·99	107	3285	11·34	35·01	26·75	131	4455
50	—	—	—	—	—	7·78	35·23	27·50	58	4935	9·89	35·28	27·37	88	6645
60	6·76	35·16	27·59	49	2880	—	—	—	—	—	—	—	—	—	—
70	—	—	—	—	—	7·03	35·28	27·66	47	5985	8·31	35·28	27·46	64	8165
80	6·80	35·16	27·59	50	3870	—	—	—	—	—	—	—	—	—	—
100	6·81	35·16	27·59	50	4870	6·95	35·28	27·72	46	7380	7·39	35·28	27·60	51	9890
145	6·73	35·16	27·60	50	7120	—	—	—	—	—	—	—	—	—	—
150	—	—	—	—	—	6·88	35·28	27·73	46	9680	7·36	35·28	27·61	51	10910

STATION SC. 6c.

Latitude, 60° 3′ N. ; Longitude, 1° 4′ E.

	3rd July, 1908.					—					—				
0	11·75	35·17	26·79	126	0	—	—	—	—	—	—	—	—	—	—
10	11·80	35·17	26·78	127	1265	—	—	—	—	—	—	—	—	—	—
20	11·58	35·21	26·85	120	2500	—	—	—	—	—	—	—	—	—	—
30	10·01	35·14	27·08	100	3600	—	—	—	—	—	—	—	—	—	—
50	6·58	35·21	27·66	44	5040	—	—	—	—	—	—	—	—	—	—
70	6·59	35·21	27·66	45	5930	—	—	—	—	—	—	—	—	—	—
100	6·46	35·21	27·68	44	7265	—	—	—	—	—	—	—	—	—	—
135	6·40	35·21	27·69	43	8788	—	—	—	—	—	—	—	—	—	—

STATION SC. 7.

Latitude, 61° 6′ N. ; Longitude, 2° 1′ E.

	21st May, 1907.					28th August, 1907.					14th March, 1908.				
0	7·45	35·28	27·60	51	0	11·65	34·38	26·17	184	0	5·75	35·01	27·62	48	0
10	7·56	35·28	27·58	52	515	11·50	34·49	26·30	173	1785	7·10	35·08	27·49	61	545
20	7·56	35·23	27·61	50	1025	11·34	34·58	26·41	164	3470	—	—	—	—	—
30	7·56	35·23	27·54	56	1555	10·91	34·88	26·72	133	4955	7·08	35·08	27·49	61	1765
40	7·52	35·25	27·54	57	2120	9·22	35·26	27·31	79	6015	—	—	—	—	—
60	7·51	35·28	27·55	55	4240	8·40	35·28	27·45	65	7455	6·94	35·16	27·58	54	3490
80	7·51	35·28	27·58	54	5330	8·00	35·28	27·51	60	8705	—	—	—	—	—
100	7·33	35·28	27·61	51	6380	7·73	35·28	27·55	56	9865	6·95	35·16	27·58	55	5670
125	—	—	—	—	—	7·19	35·30	27·65	48	11165	—	—	—	—	—
140	—	—	—	—	—	—	—	—	—	—	6·95	35·53	27·88	29	7350
148	7·09	35·27	27·65	50	8804	—	—	—	—	—	—	—	—	—	—

	24th September, 1908.					—					—				
0	11·25	34·61	26·45	159	0	—	—	—	—	—	—	—	—	—	—
10	11·33	34·58	26·41	163	1610	—	—	—	—	—	—	—	—	—	—
20	11·28	34·63	26·45	158	3215	—	—	—	—	—	—	—	—	—	—
30	11·25	34·65	26·47	156	4785	—	—	—	—	—	—	—	—	—	—
50	9·06	35·19	27·28	81	7155	—	—	—	—	—	—	—	—	—	—
70	8·65	35·28	27·41	68	8645	—	—	—	—	—	—	—	—	—	—
100	8·31	35·28	27·44	64	10625	—	—	—	—	—	—	—	—	—	—
130	8·13	35·28	27·49	63	12530	—	—	—	—	—	—	—	—	—	—

STATION SC. 7a.

Latitude, 60° 45′ N. ; Longitude, 2° 30′ E.

	26th May, 1907.					28th August, 1907.					14th March, 1908.				
0	8·05	35·09	27·37	73	0	11·35	33·80	25·80	221	0	6·35	35·16	27·64	44	0
10	8·08	35·13	27·39	71	720	11·50	33·71	25·70	231	2260	6·50	35·16	27·62	46	455
20	7·42	35·17	27·52	58	1365	11·40	34·47	26·21	174	4285	—	—	—	—	—
30	7·36	35·18	27·54	57	1940	—	—	—	—	—	6·50	35·16	27·62	46	1375
40	7·24	35·18	27·55	57	2510	8·35	35·25	27·43	66	6685	—	—	—	—	—
60	7·20	35·20	27·57	54	3620	8·12	35·30	27·51	60	7945	6·50	35·16	27·62	47	2770
80	6·49	35·24	27·70	42	4580	7·73	35·30	27·57	55	9095	6·50	35·17	27·65	47	3710
100	6·29	35·27	27·75	36	5360	7·51	35·34	27·63	49	10135	—	—	—	—	—
120	6·03	35·26	27·78	35	6070	—	—	—	—	—	6·51	35·19	27·65	46	5570

STATION SC. 7*a*—*continued*.

Latitude, 60° 45′ N. ; Longitude, 2° 30′ E.—*continued*.

Depth (Metres).	Temp. °C.	S.°/oo	σt	v—v′.	e—e′.	Temp. °C.	S.°/oo	σt	v—v′.	e—e′.	Temp. °C.	S.°/oo	σt	v—v′.	e—e′.
	6th July, 1908.					24th September, 1908.					—				
0	11·65	34·25	26·09	193	0	11·45	34·31	26·16	185	0	—	—	—	—	—
10	11·79	34·33	26·11	119	1915	11·35	34·43	26·29	175	1800	—	—	—	—	—
20	11·02	35·12	26·88	117	3450	11·35	34·43	26·29	175	3550	—	—	—	—	—
30	9·92	35·19	27·14	94	4505	11·40	34·67	26·46	157	5210	—	—	—	—	—
40	—	—	—	—	—	9·94	35·01	27·00	109	6540	—	—	—	—	—
50	8·64	35·25	27·38	70	6145	8·40	35·19	27·38	71	7440	—	—	—	—	—
70	7·69	35·26	27·55	57	7415	7·53	35·19	27·49	60	8750	—	—	—	—	—
100	7·69	35·26	27·55	57	9125	7·06	35·21	27·60	53	10445	—	—	—	—	—

STATION SC. 7*b*.

Latitude, 60° 35′ N. ; Longtitude, 1° 50′ E.

	26th May, 1907.					15th March, 1908.					24th September, 1908.				
0	7·85	35·27	27·54	57	0	6·05	35·03	27·59	50	0	11·25	34·61	26·45	159	0
10	7·82	35·27	27·54	57	570	6·46	35·12	27·60	48	490	11·37	34·74	26·53	151	1550
20	7·19	35·27	27·63	48	1095	—	—	—	—	—	11·24	34·76	26·56	148	3045
30	7·18	35·26	27·62	48	1575	6·46	35·12	27·60	48	1450	10·42	34·97	26·89	119	4380
40	7·12	35·27	27·64	49	2060	—	—	—	—	—	8·80	35·26	27·38	72	5335
50	—	—	—	—	—	—	—	—	—	—	8·62	35·26	27·41	69	6040
60	7·03	35·26	27·65	47	3020	6·50	35·12	27·59	50	2920	—	—	—	—	—
70	—	—	—	—	—	—	—	—	—	—	8·19	35·26	27·47	63	7360
80	7·01	35·27	27·66	48	3970	6·50	35·14	27·61	50	3920	—	—	—	—	—
100	6·83	35·27	27·71	44	4890	—	—	—	—	—	7·39	35·26	27·59	53	9100
120	—	—	—	—	—	—	—	—	—	—	6·97	35·26	27·65	47	10100
125	—	—	—	—	—	6·51	35·16	27·62	48	6125	—	—	—	—	—
140	6·33	35·27	27·75	38	6530	—	—	—	—	—	—	—	—	—	—

STATION SC. 7*c*.

Latitude, 60° 34′ N. ; Longitude, 1° 15′ E.

	25th May, 1907.					25th March, 1908.					25th September, 1908.				
0	8·15	35·31	27·52	58	0	6·65	35·21	27·66	44	0	11·25	34·78	26·57	146	0
10	7·78	35·27	27·54	56	570	6·92	35·19	27·59	50	470	11·20	34·78	26·58	145	1455
20	7·64	35·29	27·57	52	1110	—	—	—	—	—	11·15	34·87	26·67	138	2870
30	7·51	35·29	27·60	51	1625	6·92	35·19	27·59	50	1470	11·13	34·96	26·74	131	4215
40	7·42	35·27	27·60	53	2145	—	—	—	—	—	10·10	35·10	27·03	105	5395
50	—	—	—	—	—	—	—	—	—	—	8·80	35·07	27·20	87	6355
60	7·36	35·27	27·61	53	3205	6·92	35·19	27·59	51	2985	—	—	—	—	—
70	—	—	—	—	—	—	—	—	—	—	8·34	35·07	27·30	80	8025
80	7·30	35·27	27·61	52	4255	6·92	35·19	27·59	52	4015	—	—	—	—	—
100	7·12	35·27	27·64	50	5275	6·93	35·19	27·60	52	5055	7·21	35·07	27·46	65	10200
130	—	—	—	—	—	—	—	—	—	—	7·21	35·07	27·46	66	12165
138	6·83	35·27	27·69	46	7099	—	—	—	—	—	—	—	—	—	—
140	—	—	—	—	—	6·93	35·21	27·62	52	7135	—	—	—	—	—

STATION SC. 8.

Latitude, 61° 30′ N. ; Longitude, 3° 3′ E.

	20th May, 1907.					28th August, 1907.					14th March, 1908.				
0	6·85	34·12	26·76	128	0	11·30	33·40	25·50	251	0	6·05	34·74	27·36	72	0
10	6·91	34·19	26·82	124	1260	11·12	33·44	25·56	244	2475	6·12	34·70	27·32	76	740
20	6·70	34·23	26·87	119	2475	9·60	33·95	26·22	181	4600	—	—	—	—	—
30	6·55	34·32	26·97	110	3620	8·02	34·43	26·85	121	6110	6·19	34·70	27·31	77	2270
40	6·55	34·37	27·01	109	4715	7·17	34·65	27·14	95	7190	—	—	—	—	—
60	6·16	34·65	27·27	82	6625	6·58	34·85	27·37	71	8850	6·18	34·70	27·32	78	4595
80	6·39	34·89	27·46	66	8105	7·19	35·03	27·43	68	10240	7·00	34·90	27·37	75	6125
100	6·60	35·04	27·53	58	9345	7·83	35·23	27·50	61	11530	7·21	34·90	27·34	77	7645
125	—	—	—	—	—	6·04	35·05	27·60	50	12918	—	—	—	—	—
150	7·21	35·18	27·56	58	12245	6·00	35·03	27·60	52	14193	7·58	35·16	27·45	63	11145
200	6·92	35·15	27·58	57	15120	6·00	35·03	27·60	53	16818	7·72	35·16	27·46	66	14370
250	7·00	35·21	27·61	55	17920	5·87	35·03	27·61	52	19443	—	—	—	—	—
300	6·84	35·18	27·62	55	20670	5·89	35·12	27·68	46	21893	7·21	35·16	27·53	62	20770
370	—	—	—	—	—	5·96	35·12	27·67	46	25113	—	—	—	—	—
390	—	—	—	—	—	—	—	—	—	—	6·33	35·10	27·61	55	26035
398	6·62	35·16	27·62	54	26011	—	—	—	—	—	—	—	—	—	—

STATION SC. 8—*continued.*

Latitude, 61° 35′ N. ; Longitude, 3° ′20 E.—*continued.*

Depth (Metres).	Temp. °C.	S.°/₀₀	σt	v—v′.	e—e′.	Temp. °C.	S.°/₀₀	σt	v—v′.	e—e′.	Temp. °C.	S.°/₀₀	σt	v—v′.	e—e′.
	9th July, 1908.					24th September 1908.					—				
0	10·35	33·06	25·40	260	0	10·85	34·85	26·71	135	0	—	—	—	—	—
10	10·02	33·15	25·53	248	2540	10·82	34·85	26·71	135	1350	—	—	—	—	—
20	9·32	33·21	25·68	232	4940	10·77	34·96	26·79	125	2650	—	—	—	—	—
30	9·05	33·84	26·22	181	7005	10·43	35·12	26·99	108	3815	—	—	—	—	—
50	8·52	34·61	26·92	116	9975	9·34	35·19	27·23	85	5745	—	—	—	—	—
70	5·95	34·65	27·30	80	11935	8·80	35·21	27·34	77	7365	—	—	—	—	—
100	6·09	34·79	27·40	71	14200	8·54	35·23	27·39	71	9585	—	—	—	—	—
150	6·41	34·97	27·50	63	17550	—	—	—	—	—	—	—	—	—	—
200	6·94	34·97	27·43	71	20900	7·52	35·17	27·50	64	16335	—	—	—	—	—
250	6·93	35·03	27·47	67	24350	—	—	—	—	—	—	—	—	—	—
300	6·73	35·05	27·51	64	27625	7·13	35·16	27·54	61	22585	—	—	—	—	—
370	—	—	—	—	—	6·71	35·12	27·59	58	26750	—	—	—	—	—
390	6·45	34·99	27·51	65	33430	—	—	—	—	—	—	—	—	—	—

STATION SC. 8*a*.

Latitude, 61° 35′ N. ; Longitude, 3° 35′ E.

	8th July, 1908.					24th September, 1908.					—				
0	10·15	31·64	24·32	—	—	11·35	33·26	25·38	262	0	—	—	—	—	—
10	9·72	33·04	25·51	—	—	10·90	33·82	25·90	212	2370	—	—	—	—	—
20	8·50	33·49	26·04	—	—	10·70	34·22	26·24	179	4325	—	—	—	—	—
30	7·40	33·82	26·46	—	—	10·60	34·38	26·39	167	6055	—	—	—	—	—
50	6·18	34·40	27·07	—	—	10·68	34·83	26·72	135	9075	—	—	—	—	—
70	5·73	34·56	27·26	—	—	8·23	34·99	27·25	85	11275	—	—	—	—	—
100	5·81	34·65	27·32	—	—	8·03	35·12	27·39	72	13630	—	—	—	—	—
150	6·52	34·85	27·38	—	—	—	—	—	—	—	—	—	—	—	—
200	6·91	34·92	27·39	—	—	7·32	35·08	27·45	68	20630	—	—	—	—	—
250	6·92	34·96	27·42	—	—	—	—	—	—	—	—	—	—	—	—
300	6·73	—	27·44	—	—	6·68	—	27·55	61	27080	—	—	—	—	—
360	—	—	—	—	—	6·64	35·10	27·57	59	30680	—	—	—	—	—
380	6·52	—	27·47	—	—	—	—	—	—	—	—	—	—	—	—

STATION SC. 8*b*.

Latitude, 61° 35′ N. ; Longitude, 3° 50′ E.

	8th August, 1908.					24th September, 1908.					—				
0	9·05	33·33	25·82	219	0	12·40	32·74	24·77	320	0	—	—	—	—	—
10	8·14	33·71	26·27	177	1980	11·90	33·10	25·15	275	3020	—	—	—	—	—
20	6·81	33·87	26·56	148	3605	11·66	33·28	25·34	266	5770	—	—	—	—	—
30	6·32	34·16	26·89	119	4940	11·05	33·78	25·84	217	3185	—	—	—	—	—
50	5·64	34·58	27·28	80	6930	8·53	34·79	27·05	104	11395	—	—	—	—	—
70	5·66	34·69	27·36	73	8460	7·88	35·01	27·33	78	13215	—	—	—	—	—
100	5·82	34·83	27·46	65	10530	7·86	35·14	27·43	69	15420	—	—	—	—	—
150	6·21	34·94	27·51	62	13655	—	—	—	—	—	—	—	—	—	—
200	6·23	34·94	27·51	62	16755	7·03	35·14	27·55	59	21820	—	—	—	—	—
250	6·23	35·03	27·58	57	19730	—	—	—	—	—	—	—	—	—	—
300	6·22	35·03	27·58	58	22605	6·52	35·14	27·62	52	27370	—	—	—	—	—
325	—	—	—	—	—	6·52	35·14	27·62	52	28670	—	—	—	—	—
340	6·22	35·03	27·58	58	24925	—	—	—	—	—	—	—	—	—	—

STATION SC. 8*c*.

Latitude, 61° 35′ N. ; Longitude, 4° 5′ E.

	8th July, 1908.					24th September, 1908.					—				
0	8·25	33·19	25·84	218	0	12·45	32·52	24·60	338	0	—	—	—	—	—
10	7·61	33·66	26·30	175	1965	12·35	32·65	24·71	326	3320	—	—	—	—	—
20	7·38	33·86	26·48	156	3620	12·08	32·88	24·95	304	6470	—	—	—	—	—
30	7·00	34·14	26·77	130	5050	11·50	33·62	25·63	238	9180	—	—	—	—	—
50	6·00	34·51	27·19	90	7250	10·10	34·25	26·37	168	13240	—	—	—	—	—
70	5·82	34·69	27·34	74	8890	7·96	34·97	27·29	82	15740	—	—	—	—	—
100	5·79	34·79	27·44	68	11020	7·96	35·07	27·36	75	18095	—	—	—	—	—
150	5·99	34·96	27·54	58	14170	—	—	—	—	—	—	—	—	—	—
200	6·73	35·01	27·49	64	17220	6·91	35·08	27·51	62	24945	—	—	—	—	—
270	—	—	—	—	—	6·76	35·10	27·55	60	29215	—	—	—	—	—
285	6·34	35·21	27·70	46	21725	—	—	—	—	—	—	—	—	—	—

Station Sc. 9.

Latitude, 61° 34′ N. ; Longitude, 2° 4′ E.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt	v—v′.	e—e′.	Temp. °C.	S.°/₀₀	σt.	v—v′.	e—e′.	Temp. °C.	S.°/₀₀	σt.	v—v′.	e—e′.
	20th May, 1907.					28th August, 1907.					14th March, 1908.				
0	7·75	34·88	27·24	85	0	10·95	35·21	26·97	109	0	7·05	35·17	27·57	53	0
10	7·30	34·84	27·25	81	830	11·00	35·26	27·00	106	1075	7·28	35·14	27·50	59	560
20	7·30	34·82	27·24	83	1650	10·99	35·26	27·00	106	2135	—	—	—	—	—
30	7·39	34·97	27·35	73	2430	10·98	35·26	27·00	106	4195	7·41	35·17	27·52	58	1730
40	7·70	35·14	27·43	65	3120	10·98	35·26	27·00	107	5260	—	—	—	—	—
60	7·81	35·13	27·42	67	4440	10·31	35·26	27·12	98	7310	7·45	35·17	27·51	59	3485
80	7·89	35·17	27·44	66	5770	9·50	35·26	27·27	85	9140	—	—	—	—	—
100	7·85	35·23	27·50	62	7050	9·31	35·26	27·30	82	10810	7·43	35·19	27·53	59	5845
150	7·77	35·23	27·51	61	10125	8·98	35·30	27·38	74	14710	7·44	35·19	27·53	60	8820
200	7·46	35·20	27·53	61	13175	8·52	35·30	27·45	69	18285	—	—	—	—	—
250	7·13	35·18	27·57	59	16175	8·34	35·25	27·43	70	21760	7·47	35·21	27·54	61	14870
300	7·02	35·21	27·61	56	19050	7·99	35·19	27·44	70	25260	6·73	35·12	27·57	57	17820
325	—	—	—	—	—	7·88	35·19	27·45	70	27010	—	—	—	—	—
350	—	—	—	—	—	—	—	—	—	—	6·30	35·12	27·62	53	20570
362	5·99	35·10	27·67	50	22336	—	—	—	—	—	—	—	—	—	—

Depth (Metres).	Temp. °C.	S.°/₀₀	σt	v—v′.	e—e′.	Temp. °C.	S.°/₀₀	σt.	v—v′.	e—e′.	Temp. °C.	S.°/₀₀	σt.	v—v′.	e—e′.
	9th July, 1907.					23rd September, 1908.					—				
0	11·25	32·83	25·07	293	0	10·55	35·12	26·96	109	0	—	—	—	—	—
10	11·31	32·94	25·13	286	2895	10·51	35·12	26·97	109	1090	—	—	—	—	—
20	10·22	35·16	27·06	102	4835	10·22	35·12	27·03	104	2155	—	—	—	—	—
30	9·79	35·21	27·27	90	5795	10·19	35·14	27·04	103	3190	—	—	—	—	—
50	8·98	35·26	27·35	75	7445	10·02	35·19	27·12	97	5190	—	—	—	—	—
70	8·89	35·26	27·36	74	8935	9·04	35·28	27·35	75	6910	—	—	—	—	—
100	8·70	35·26	27·39	72	11125	8·53	35·28	27·43	67	9040	—	—	—	—	—
150	8·44	35·26	27·44	69	14650	—	—	—	—	—	—	—	—	—	—
200	8·37	35·26	27·45	69	18100	7·71	35·23	27·51	62	15490	—	—	—	—	—
290	8·03	35·26	27·50	66	24175	—	—	—	—	—	—	—	—	—	—
300	—	—	—	—	—	7·17	35·17	27·55	61	21640	—	—	—	—	—
350	—	—	—	—	—	6·60	35·16	27·61	53	24490	—	—	—	—	—

Station Sc. 10.

Latitude, 61° 35′ N. ; Longitude, 0° 47′ E.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt	v—v′.	e—e′.	Temp. °C.	S.°/₀₀	σt.	v—v′.	e—e′.	Temp. °C.	S.°/₀₀	σt.	v—v′.	e—e′.
	20th May, 1907.					27th August, 1907.					14th March, 1908.				
0	8·05	35·26	27·50	61	0	11·50	35·19	26·84	121	0	7·15	35·25	27·61	49	0
10	8·00	35·23	27·47	62	615	11·26	35·14	26·85	119	1200	7·42	35·25	27·57	53	510
20	7·91	35·23	27·48	61	1230	11·14	35·19	26·91	114	2365	—	—	—	—	—
30	7·90	35·23	27·48	61	1840	11·02	35·19	26·94	111	3490	7·42	35·25	27·57	53	1570
40	7·90	35·24	27·48	61	2445	10·90	35·19	26·96	111	4600	—	—	—	—	—
60	7·90	35·23	27·48	62	3675	9·40	35·28	27·29	81	6520	7·42	35·25	27·57	54	3175
80	7·90	35·25	27·49	61	4905	8·95	35·32	27·39	71	8040	—	—	—	—	—
100	7·73	35·23	27·51	60	6115	8·55	35·32	27·45	65	9400	7·43	35·26	27·59	54	5335
150	7·54	35·23	27·56	59	9090	8·31	35·28	27·46	65	12650	—	—	—	—	—
200	—	—	—	—	—	7·91	35·25	27·49	63	15850	7·44	35·26	27·59	56	10835
208	7·50	35·25	27·56	58	12483	—	—	—	—	—	—	—	—	—	—

Depth (Metres).	Temp. °C.	S.°/₀₀	σt	v—v′.	e—e′.	Temp. °C.	S.°/₀₀	σt.	v—v′.	e—e′.	Temp. °C.	S.°/₀₀	σt.	v—v′.	e—e′.
	9th July, 1908.					23rd September, 1908.					—				
0	11·05	35·30	27·02	104	0	10·85	35·21	26·97	—	—	—	—	—	—	—
10	11·08	35·30	27·01	105	1045	10·80	35·21	27·00	—	—	—	—	—	—	—
20	10·89	35·32	27·06	100	2070	10·72	35·21	27·01	—	—	—	—	—	—	—
30	10·05	35·32	27·21	86	3000	10·68	35·21	27·02	—	—	—	—	—	—	—
50	9·10	35·30	27·36	74	4000	10·68	35·23	27·03	—	—	—	—	—	—	—
70	8·82	35·30	27·41	70	6040	10·35	35·28	27·13	—	—	—	—	—	—	—
100	8·59	35·28	27·44	68	8110	9·13	35·30	27·42	—	—	—	—	—	—	—
150	8·26	35·28	27·47	64	11410	—	—	—	—	—	—	—	—	—	—
198	7·94	35·32	27·55	58	14338	—	—	—	—	—	—	—	—	—	—
200	—	—	—	—	—	8·72	35·30	27·42	—	—	—	—	—	—	—

Station Sc. 11.

Latitude, 61° 38′ N. ; Longitude, 0° 41′ W.

Depth (Metres).	Temp. °C.	S.°/oo	σt.	v—v′.	e—e′.	Temp. °C.	S.°/oo	σt.	v—v′.	e—e′.	Temp. °C.	S.°/oo	σt.	v—v′.	e—e′.
	20th May, 1907.					26th August, 1907.					13th March, 1908.				
0	7·65	35·45	27·71	41	0	10·95	35·28	27·02	104	0	7·25	34·85	27·28	—	—
10	8·39	35·24	27·43	66	535	11·01	35·32	27·04	102	1030	7·72	34·88	27·25	—	—
20	8·39	35·23	27·42	67	1200	10·99	35·32	27·04	102	2050	—	—	—	—	—
30	8·39	35·23	27·42	67	1870	10·99	35·32	27·04	102	3070	7·72	34·88	27·25	—	—
40	8·38	35·25	27·43	66	2535	10·99	35·32	27·04	101	4085	—	—	—	—	—
50	—	—	—	—	—	—	—	—	—	—	7·72	34·88	27·25	—	—
60	8·39	35·23	27·42	68	3875	9·89	35·26	27·20	90	5995	—	—	—	—	—
80	8·39	35·25	27·43	67	5225	9·52	35·32	27·30	80	7695	—	—	—	—	—
100	8·39	35·23	27·42	69	6585	9·31	35·32	27·33	77	9265	7·73	34·88	27·25	—	—
150	7·90	35·25	27·50	62	9860	9·02	35·32	27·38	73	13015	—	—	—	—	—
200	—	—	—	—	—	9·00	35·32	27·38	75	16740	7·66	34·90	27·27	—	—
218	7·71	35·21	27·50	63	14210	—	—	—	—	—	—	—	—	—	—
	23rd September, 1908.					—					—				
0	10·60	36·26	27·07	—	—	—	—	—	—	—	—	—	—	—	—
10	10·48	35·21	27·05	—	—	—	—	—	—	—	—	—	—	—	—
20	10·44	35·21	27·06	—	—	—	—	—	—	—	—	—	—	—	—
30	10·35	35·25	27·10	—	—	—	—	—	—	—	—	—	—	—	—
50	10·10	35·30	27·19	—	—	—	—	—	—	—	—	—	—	—	—
70	9·51	35·32	27·30	—	—	—	—	—	—	—	—	—	—	—	—
100	9·39	35·32	27·32	—	—	—	—	—	—	—	—	—	—	—	—
200	9·01	35·32	27·38	—	—	—	—	—	—	—	—	—	—	—	—

Station Sc. 11*a*.

Latitude, 61° 42′ N. ; Longitude, 2° 0′ W.

Depth (Metres).	Temp. °C.	S.°/oo	σt.	v—v′.	e—e′.	Temp. °C.	S.°/oo	σt.	v—v′.	e—e′.	Temp. °C.	S.°/oo	σt.	v—v′.	e—e′.
	19th May, 1907.					26th August, 1907.					13th March, 1908.				
0	8·35	35·30	27·48	62	0	10·45	35·26	27·10	98	0	7·25	34·90	27·33	77	0
10	8·52	35·26	27·42	67	645	10·54	35·25	27·06	100	990	—	—	—	—	—
20	8·51	35·23	27·40	69	1325	10·53	35·21	27·04	103	2005	7·30	34·87	27·30	79	1560
30	8·30	35·21	27·41	68	2010	10·44	35·21	27·06	101	3025	—	—	—	—	—
40	8·00	35·22	27·47	63	2665	10·41	35·21	27·07	103	4045	—	—	—	—	—
50	—	—	—	—	—	—	—	—	—	—	6·78	34·83	27·34	76	3885
60	7·87	35·20	27·47	63	3925	9·20	35·19	27·26	84	5915	—	—	—	—	—
80	7·71	35·18	27·48	64	5195	8·42	35·23	27·41	78	7535	—	—	—	—	—
100	7·37	35·17	27·52	61	6445	8·11	35·23	27·45	66	8975	6·62	34·81	27·35	76	7685
150	6·92	35·16	27·57	55	9345	7·50	35·23	27·54	58	12075	—	—	—	—	—
200	6·68	35·17	27·61	52	12020	7·04	35·19	27·58	56	14925	5·71	34·67	27·35	76	15285
250	6·40	35·13	27·63	52	14620	6·54	35·10	27·59	55	17700	—	—	—	—	—
300	5·68	35·12	27·72	43	16995	5·54	35·01	27·65	50	20325	3·59	34·60	27·53	59	22035
350	5·08	35·04	27·72	43	19145	3·56	34·87	27·74	39	22550	—	—	—	—	—
400	3·04	34·85	27·78	35	21095	1·72	34·85	27·89	24	24125	0·92	34·51	27·68	43	27135
450	2·27	35·01	27·99	16	22370	—	—	—	—	—	—	—	—	—	—
500	+2·75	34·82	27·85	18	23220	+0·38	34·87	28·00	12	25925	—	—	—	—	—
600	+2·03	34·95	28·09	3	24270	—0·04	34·87	28·02	9	26975	0·06	34·51	27·73	37	35135
700	—2·30	34·93	28·09	2	24520	—	—	—	—	—	—	—	—	—	—
800	—2·42	34·88	28·05	4	24820	—0·57	34·87	28·05	5	28375	—0·43	34·51	27·75	34	42235
900	—2·62	34·92	28·09	0	25020	—	—	—	—	—	—	—	—	—	—
1000	—2·71	34·93	28·10	0	25020	—0·78	34·87	28·06	3	29175	—0·42	34·51	27·75	34	49035
1200	—2·74	34·86	28·01	9	25920	—1·02	34·88	28·08	—2	29275	—	—	—	—	—
1300	—	—	—	—	—	—	—	—	—	—	—0·34	34·51	27·74	33	59085
	23rd September, 1908.					—					—				
0	9·85	35·08	27·06	102	0	—	—	—	—	—	—	—	—	—	—
10	9·82	35·08	27·06	102	1020	—	—	—	—	—	—	—	—	—	—
20	9·82	35·08	27·06	102	2040	—	—	—	—	—	—	—	—	—	—
30	9·80	35·08	27·06	102	3060	—	—	—	—	—	—	—	—	—	—
50	9·32	35·19	27·23	85	4930	—	—	—	—	—	—	—	—	—	—
70	9·00	35·19	27·29	80	6580	—	—	—	—	—	—	—	—	—	—
100	7·51	35·19	27·52	60	8680	—	—	—	—	—	—	—	—	—	—
200	7·47	35·19	27·52	62	14780	—	—	—	—	—	—	—	—	—	—
400	4·91	35·07	27·76	39	24880	—	—	—	—	—	—	—	—	—	—
600	2·03	34·87	27·89	26	31380	—	—	—	—	—	—	—	—	—	—
800	—0·41	34·96	28·11	0	33980	—	—	—	—	—	—	—	—	—	—
1000	—0·97	34·94	28·13	—2	33780	—	—	—	—	—	—	—	—	—	—
1200	—1·17	34·97	28·16	—6	32980	—	—	—	—	—	—	—	—	—	—

Station. Sc. 12.

Latitude, 61° 2′ N. ; Longitude, 1° 10′ W.

Depth (Metres).	Temp. °C.	S.°/∞	σt.	v—v′.	e—e′.	Temp. °C.	S.°/∞	σt.	v—v′.	e—e′.	Temp. °C.	S.°/∞	σt.	v—v′.	e—e′.
	15th May, 1907.					26th August, 1907.					13th March, 1908.				
0	9·15	35·28	27·35	75	0	10·85	35·28	27·04	101	0	7·35	34·87	27·29	80	0
10	8·76	35·28	27·40	69	720	11·00	35·26	27·00	106	1035	7·45	34·90	27·30	79	795
20	8·61	35·25	27·39	68	1405	10·98	35·26	27·00	106	2095	—	—	—	—	—
30	8·59	35·26	27·41	68	2085	10·91	35·26	27·02	104	3145	7·48	34·90	27·29	79	2375
40	8·52	35·26	27·42	68	2765	10·91	35·26	27·02	105	4190	—	—	—	—	—
60	8·21	35·25	27·45	65	4095	9·12	35·23	27·30	80	6040	7·48	34·90	27·29	81	4775
80	8·08	35·28	27·49	62	5365	8·99	35·26	27·35	76	7600	—	—	—	—	—
100	7·72	35·28	27·56	56	6545	8·82	35·26	27·38	73	9090	7·49	34·90	27·29	81	8015
125	—	—	—	—	—	8·79	35·26	27·38	74	10928	7·49	34·90	27·29	81	10040
131	7·52	35·30	27·61	52	8219	—	—	—	—	—	—	—	—	—	—
	22nd September, 1908.					—					—				
0	10·75	35·23	27·01	104	0	—	—	—	—	—	—	—	—	—	—
10	10·70	35·23	27·02	104	1040	—	—	—	—	—	—	—	—	—	—
20	10·68	35·23	27·03	104	2080	—	—	—	—	—	—	—	—	—	—
30	10·63	35·23	27·04	104	3120	—	—	—	—	—	—	—	—	—	—
50	10·55	35·23	27·06	103	5190	—	—	—	—	—	—	—	—	—	—
70	9·60	35·28	27·26	83	7050	—	—	—	—	—	—	—	—	—	—
100	9·19	35·28	27·32	78	9465	—	—	—	—	—	—	—	—	—	—
130	9·15	35·28	27·32	78	11805	—	—	—	—	—	—	—	—	—	—

Station Sc. 13*a*.

Latitude, 61° 9′ N. ; Longitude, 2° 14′ W.

	6th July, 1907.					9th April, 1908.					7th June, 1908.				
0	10·35	35·39	27·22	86	0	7·95	35·32	27·55	55	0	9·35	35·35	27·36	73	0
10	10·12	35·34	27·22	85	855	7·82	35·32	27·57	53	540	7·62	35·34	27·64	48	605
20	9·82	35·32	27·25	83	1695	7·68	35·30	27·58	52	1065	7·60	35·34	27·64	48	1085
30	9·41	35·32	27·32	77	2495	7·68	35·30	27·58	52	1585	7·58	35·32	27·60	50	1575
50	9·12	35·32	27·36	73	3925	7·66	35·30	27·58	53	2110	7·48	35·32	27·61	49	2565
70	8·99	35·35	27·41	69	5345	7·62	35·26	27·56	55	3190	7·10	35·32	27·67	43	3485
100	8·77	35·32	27·42	68	7400	7·48	35·26	27·57	56	4300	6·92	35·32	27·70	41	4745
150	8·55	35·32	27·45	67	10775	7·40	35·23	27·56	57	5995	—	—	—	—	—
200	8·23	35·32	27·50	63	14025	7·02	35·16	27·54	57	8845	6·70	35·35	27·76	39	8745
250	8·07	35·26	27·49	66	17250	—	—	—	—	—	—	—	—	—	—
300	7·71	35·26	27·54	62	20450	6·85	35·16	27·62	56	11670	8·02	35·25	27·48	66	14045
350	7·41	35·25	27·57	69	23725	—	—	—	—	—	—	—	—	—	—
400	6·95	35·21	27·62	56	26850	6·43	35·16	27·64	53	17120	7·18	35·25	27·61	56	20145
450	6·13	35·16	27·67	49	29475	—	—	—	—	—	—	—	—	—	—
500	4·40	35·08	27·83	35	31575	6·05	35·16	27·68	50	22270	6·00	35·16	27·67	48	25345
530	—	—	—	—	—	5·80	35·12	27·69	50	23770	—	—	—	—	—
550	—	—	—	—	—	—	—	—	—	—	5·34	35·07	27·70	48	27745
	19th August, 1908.					7th November, 1908.					—				
0	11·65	35·19	26·82	125	0	9·65	35·34	27·29	79	0	—	—	—	—	—
10	11·65	35·19	26·82	125	1250	9·74	35·21	27·19	89	840	—	—	—	—	—
20	11·11	35·19	26·92	124	2495	9·72	35·21	27·19	89	1730	—	—	—	—	—
30	10·51	35·19	27·03	104	3635	9·60	35·21	27·21	87	2610	—	—	—	—	—
50	9·75	35·21	27·18	91	5585	9·29	35·19	27·23	85	4330	—	—	—	—	—
70	9·36	35·21	27·24	85	7345	9·00	35·19	27·29	82	6000	—	—	—	—	—
100	9·19	35·23	27·29	82	9850	8·99	35·19	27·29	82	8460	—	—	—	—	—
200	8·73	35·25	27·37	75	17700	7·91	35·19	27·46	68	15960	—	—	—	—	—
300	8·51	35·25	27·40	74	25250	7·53	35·19	27·56	64	22560	—	—	—	—	—
400	7·82	35·17	27·46	71	32500	7·02	35·19	27·59	58	28660	—	—	—	—	—
500	—	—	—	—	—	5·64	35·10	27·71	48	33960	—	—	—	—	—
530	7·47	35·19	27·53	68	41535	—	—	—	—	—	—	—	—	—	—
570	—	—	—	—	—	4·45	35·05	27·82	40	37040	—	—	—	—	—

Station Sc. 14*a*.

Latitude, 61° 18′ N. ; Longitude, 2° 59′ W.

Depth (Metres).	Temp. °C.	S.‰	σ_t.	v—v′.	e—e′.	Temp. °C.	S.‰	σ_t.	v—v′.	e—e′.	Temp. °C.	S.‰	σ_t.	v—v′.	e—e′.
	9th April, 1908.					20th August, 1908.					7th November, 1908.				
0	7·85	35·32	27·56	54	0	11·05	35·10	26·87	119	0	8·15	34·96	27·74	85	0
10	7·74	35·26	27·54	55	545	11·11	35·12	26·87	118	1185	8·38	34·96	27·20	88	865
20	7·65	35·26	27·55	54	1090	11·00	35·08	26·86	120	2375	8·42	34·96	27·20	88	1745
30	7·59	35·26	27·56	53	1625	9·81	35·08	27·08	100	3475	8·44	35·01	27·23	85	2610
50	7·55	35·26	27·57	54	2695	8·16	35·08	27·33	76	5235	8·48	35·01	27·23	86	4320
70	7·54	35·26	27·57	54	3775	7·81	35·08	27·39	72	6715	8·48	35·07	27·27	82	6000
100	7·40	35·26	27·59	54	5395	7·03	35·08	27·50	61	8710	7·77	35·16	27·46	66	8220
200	6·47	35·21	27·68	47	10445	6·72	35·08	27·54	59	14710	6·22	35·16	27·66	47	13870
250	—	—	—	—	—	—	—	—	—	—	4·12	34·96	27·75	36	15945
300	5·83	35·16	27·71	43	14945	5·33	35·01	27·67	47	20010	2·97	34·94	27·86	28	17545
400	4·21	34·99	27·78	37	18945	2·36	34·76	27·77	36	24160	1·02	34·94	28·02	11	19495
450	2·08	34·83	27·85	29	20595	—	—	—	—	—	—	—	—	—	—
500	1·09	34·87	27·95	18	21770	−0·32	34·78	27·97	19	26910	0·04	34·94	28·08	5	20295
600	1·05	34·92	28·00	13	23320	−0·37	34·85	28·02	13	28510	−0·32	34·94	28·10	3	20595
700	−0·20	34·94	28·09	5	24220	−0·40	34·85	28·02	13	29810	−0·54	34·94	28·11	1	20895
800	−0·35	34·94	28·10	4	24670	−0·79	34·85	28·04	7	30810	−0·68	34·94	28·12	−1	20895
900	−0·46	34·96	28·12	0	24870	−0·72	34·85	28·04	5	31410	—	—	—	—	—
1000	−0·38	34·96	28·11	1	24920	—	—	—	—	—	−0·86	34·94	28·13	−2	20595
1050	—	—	—	—	—	−1·05	34·85	28·05	4	32085	—	—	—	—	—
1100	−0·46	34·96	28·12	0	24970	—	—	—	—	—	—	—	—	—	—
1200	−0·53	34·96	28·12	−2	24970	—	—	—	—	—	—	—	—	—	—
1300	—	—	—	—	—	—	—	—	—	—	−1·12	34·94	28·14	−2	19995

Station Sc. 15*a*.

Latitude, 61° 27′ N. ; Longitude, 3° 42′ W.

Depth (Metres).	Temp. °C.	S.‰	σ_t.	v—v′.	e—e′.	Temp. °C.	S.‰	σ_t.	v—v′.	e—e′.	Temp. °C.	S.‰	σ_t.	v—v′.	e—e′.
	7th July, 1907.					9th April, 1908.					20th August, 1908.				
0	8·25	35·19	27·39	70	0	6·35	35·21	27·69	41	0	10·45	34·90	26·82	125	0
10	8·39	35·19	27·38	70	700	6·55	35·21	27·67	44	425	10·28	34·90	26·85	122	1235
20	8·39	35·19	27·38	70	1400	6·55	35·21	27·67	44	865	9·79	34·94	26·97	111	2400
30	—	—	—	—	—	6·55	35·17	27·64	46	1315	9·55	34·97	27·04	105	3480
40	8·02	35·17	27·43	67	2770	—	—	—	—	—	—	—	—	—	—
50	—	—	—	—	—	6·53	35·14	27·63	49	2265	8·34	35·05	27·28	81	5340
60	7·49	35·17	27·51	61	4050	—	—	—	—	—	—	—	—	—	—
70	—	—	—	—	—	6·50	35·14	27·62	49	3245	7·40	35·12	27·46	63	6780
80	7·44	35·16	27·49	61	5270	—	—	—	—	—	—	—	—	—	—
100	7·34	35·14	27·50	61	6490	6·43	35·10	27·60	52	4760	7·37	35·12	27·47	63	8670
150	7·21	35·14	27·51	61	9540	—	—	—	—	—	—	—	—	—	—
200	7·02	35·19	27·59	55	12440	5·85	35·10	27·68	47	9710	6·42	35·07	27·57	56	14620
300	6·43	35·10	27·60	55	17940	4·03	34·92	27·74	39	14010	2·19	34·85	27·85	28	18820
350	—	—	—	—	—	2·32	34·83	27·83	30	15735	—	—	—	—	—
400	3·15	34·90	27·82	33	22340	1·52	34·83	27·90	23	17060	0·63	34·85	27·96	16	21020
450	1·42	34·85	27·91	20	23665	—	—	—	—	—	—	—	—	—	—
500	—	—	—	—	—	0·23	34·87	28·00	11	18760	0·11	34·87	28·01	10	22320
600	−0·09	34·88	28·03	8	25765	—	—	—	—	—	−0·30	34·87	28·04	8	23220
700	—	—	—	—	—	−0·39	34·87	28·00	8	20660	−0·47	34·88	28·06	6	23920
750	−0·39	34·87	28·04	5	26740	—	—	—	—	—	—	—	—	—	—
800	—	—	—	—	—	—	—	—	—	—	−0·59	34·88	28·06	6	24520
850	−0·59	34·87	28·05	4	27190	—	—	—	—	—	—	—	—	—	—
900	—	—	—	—	—	—	—	—	—	—	−0·69	34·88	28·07	4	25020
950	−0·66	34·85	28·03	4	27590	—	—	—	—	—	—	—	—	—	—
1000	—	—	—	—	—	−0·58	34·85	27·97	8	23060	−0·96	34·94	28·13	−3	25070
1050	−0·75	34·88	28·07	2	27890	—	—	—	—	—	—	—	—	—	—
1150	−0·89	34·92	28·11	−1	27940	—	—	—	—	—	—	—	—	—	—
1250	—	—	—	—	—	—	—	—	—	—	−1·19	34·94	28·14	−3	24320
1350	—	—	—	—	—	−0·57	34·85	27·97	7	25685	—	—	—	—	—
	7th November, 1908.					——					——				
0	8·45	35·05	27·28	83	0	—	—	—	—	—	—	—	—	—	—
10	8·49	34·97	27·22	90	865	—	—	—	—	—	—	—	—	—	—
20	8·44	34·97	27·22	89	1760	—	—	—	—	—	—	—	—	—	—
30	8·49	34·97	27·22	90	2655	—	—	—	—	—	—	—	—	—	—
50	8·50	34·97	27·22	91	4465	—	—	—	—	—	—	—	—	—	—
70	8·50	35·07	27·27	83	6205	—	—	—	—	—	—	—	—	—	—
100	8·74	35·12	27·27	83	8695	—	—	—	—	—	—	—	—	—	—
200	7·81	35·16	27·46	68	16245	—	—	—	—	—	—	—	—	—	—
300	6·83	35·16	27·58	56	22445	—	—	—	—	—	—	—	—	—	—
350	4·71	34·99	27·73	42	24895	—	—	—	—	—	—	—	—	—	—
400	3·06	34·85	27·78	35	26820	—	—	—	—	—	—	—	—	—	—
450	1·52	bottle	broken	21	28260	—	—	—	—	—	—	—	—	—	—
500	−0·12	34·88	28·04	9	29010	—	—	—	—	—	—	—	—	—	—
600	−0·03	34·88	28·03	9	29910	—	—	—	—	—	—	—	—	—	—
700	−0·24	34·90	28·06	7	30710	—	—	—	—	—	—	—	—	—	—
800	−0·40	34·90	28·07	5	31310	—	—	—	—	—	—	—	—	—	—
900	−0·53	34·90	28·08	4	31760	—	—	—	—	—	—	—	—	—	—
1000	−0·62	34·90	23·08	4	32160	—	—	—	—	—	—	—	—	—	—
1200	−0·84	34·90	28·10	0	32560	—	—	—	—	—	—	—	—	—	—
1350	−0·96	34·94	28·13	−1	32485	—	—	—	—	—	—	—	—	—	—

Station Sc. 15*b*.

Latitude, 61° 39′ N ; Longitude, 4° 45′ W.

Depth (Metres).	Temp. °C.	S.°/oo	σt.	v—v′.	e—e′.	Temp. °C.	S.°/oo	σt.	v—v′.	e—e′.	Temp. °C.	S.°/oo	σt	v—v′.	e—e′
	7th July, 1007.					10th April, 1908.					21st August, 1908.				
0	8·35	35·14	27·35	74	0	6·45	35·17	27·66	46	0	10·95	35·14	26·92	116	0
10	8·44	35·17	27·36	72	730	6·50	35·17	27·65	46	460	10·78	35·10	26·91	115	1155
20	8·38	35·17	27·37	72	1450	6·50	35·17	27·65	46	920	10·44	35·10	26·97	109	2275
30	—	—	—	—	—	6·50	35·17	27·65	46	1380	10·32	35·14	27·02	104	3340
40	8·22	35·17	27·40	71	2880	—	—	—	—	—	—	—	—	—	—
50	—	—	—	—	—	6·50	35·17	27·65	47	2310	9·48	35·19	27·21	89	5270
60	7·66	35·19	27·49	61	4200	—	—	—	—	—	—	—	—	—	—
70	—	—	—	—	—	6·49	35·17	27·65	47	3250	8·76	35·21	27·35	77	6930
80	7·50	35·19	27·51	60	5410	—	—	—	—	—	—	—	—	—	—
100	7·48	bottle	broken.	—	—	6·49	35·16	27·63	48	4675	8·02	35·19	27·44	67	9090
150	7·34	35·17	27·53	61	9645	—	—	—	—	—	—	—	—	—	—
200	7·12	35·17	27·56	59	12645	6·14	35·12	27·65	55	9825	7·82	35·19	27·47	66	15740
250	6·82	35·19	27·62	53	15445	—	—	—	—	—	—	—	—	—	—
300	—	—	—	—	—	5·17	35·01	27·69	46	14875	6·92	35·14	27·56	58	21940
400	—	—	—	—	—	3·95	34·94	27·77	39	19125	4·81	34·99	27·73	45	27090
500	—	—	—	—	—	—	—	—	—	—	—0·40	34·88	28·05	7	29690
600	—	—	—	—	—	—	—	—	—	—	—0·98	34·94	28·13	−1	29990
	7th November, 1908.					—					—				
0	8·75	35·16	27·30	79	0	—	—	—	—	—	—	—	—	—	—
10	8·82	35·08	27·23	85	820	—	—	—	—	—	—	—	—	—	—
20	8·82	35·08	27·33	85	1670	—	—	—	—	—	—	—	—	—	—
30	8·82	35·16	27·29	79	2490	—	—	—	—	—	—	—	—	—	—
50	8·82	35·16	27·29	80	4080	—	—	—	—	—	—	—	—	—	—
70	8·82	35·16	27·29	80	5680	—	—	—	—	—	—	—	—	—	—
100	8·85	35·16	27·29	81	8095	—	—	—	—	—	—	—	—	—	—
200	8·01	35·19	27·46	69	15595	—	—	—	—	—	—	—	—	—	—
300	7·61	35·19	27·50	65	22295	—	—	—	—	—	—	—	—	—	—
370	7·34	35·19	27·54	62	26740	—	—	—	—	—	—	—	—	—	—

Station Sc. 15*c*.

Latitude, 61° 34′ N. ; Longitude, 4° 16′ W.

	9th June, 1908.					—					—				
0	8·65	35·28	27·40	67	0	—	—	—	—	—	—	—	—	—	—
10	8·54	35·23	27·39	69	680	—	—	—	—	—	—	—	—	—	—
20	8·28	35·23	27·42	66	1355	—	—	—	—	—	—	—	—	—	—
30	7·92	35·23	27·48	61	1990	—	—	—	—	—	—	—	—	—	—
50	7·58	35·23	27·53	57	3170	—	—	—	—	—	—	—	—	—	—
70	7·32	35·19	27·54	57	4310	—	—	—	—	—	—	—	—	—	—
100	7·21	35·19	27·56	56	5405	—	—	—	—	—	—	—	—	—	—
200	6·88	35·19	27·61	54	10905	—	—	—	—	—	—	—	—	—	—
300	6·22	35·19	27·69	44	15805	—	—	—	—	—	—	—	—	—	—
400	4·78	35·03	27·75	42	20105	—	—	—	—	—	—	—	—	—	—
500	1·33	34·79	27·88	25	23455	—	—	—	—	—	—	—	—	—	—
600	0·54	34·88	28·00	12	25305	—	—	—	—	—	—	—	—	—	—
700	—0·22	34·92	28·07	6	26205	—	—	—	—	—	—	—	—	—	—
750	—0·47	84·94	28·11	1	26380	—	—	—	—	—	—	—	—	—	—

Station Sc. 16.

Latitude, 62° 00′ N. ; Longitude, 6° 12′ W.

	8th July, 1907.					10th April, 1908.					9th June, 1908.				
0	7·85	35·19	27·46	63	0	6·60	35·17	27·64	47	0	7·75	35·17	27·47	62	0
10	7·96	35·19	27·44	64	635	6·49	35·14	27·62	48	530	7·72	35·19	27·48	61	615
20	7·90	35·19	27·45	63	1270	6·40	35·14	27·63	46	1070	7·72	35·19	27·48	61	1225
30	7·88	35·19	27·45	63	1900	6·38	35·14	27·63	46	1585	7·60	35·23	27·53	56	1910
40	7·88	35·12	27·40	70	2565	—	—	—	—	—	—	—	—	—	—
50	—	—	—	—	—	6·31	35·14	27·64	46	2605	7·0	35·25	27·63	48	2950
60	7·88	35·12	27·40	70	3965	—	—	—	—	—	—	—	—	—	—
70	—	—	—	—	—	6·30	35·16	27·65	46	3645	7·01	35·19	27·59	52	3950
80	7·89	35·12	27·40	71	5375	—	—	—	—	—	—	—	—	—	—
90	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
100	7·89	35·12	27·40	71	6795	6·30	35·16	27·65	46	5205	7·01	35·19	27·59	53	5000
110	—	—	—	—	—	6·29	35·17	27 67	45	6225	7·01	35·23	27·62	47	6000
128	7·89	35·12	27·40	71	8783	—	—	—	—	—	—	—	—	—	—

Station Sc. 16—*continued.*

Latitude, 62° 00′ N. ; Longitude, 6° 12′ W.—*continued.*

Depth (Metres).	Temp. °C.	S.°/∞	σt.	v—v′.	e—e′.	Temp. °C.	S.°/∞	σt.	v—v′.	e—e′.	Temp. °C.	S.°/∞	σt.	v—v′.	e—e′.
	21st August, 1908.					8th November, 1908.					—				
0	10·15	35·10	27·03	105	0	8·55	35·10	27·24	85	0	—	—	—	—	—
10	9·90	35·16	27·11	96	1005	9·00	35·10	27·22	86	855	—	—	—	—	—
20	9·44	35·14	27·17	91	1940	9·00	35·10	27·22	86	1715	—	—	—	—	—
30	9·32	35·10	27·16	91	2850	9·00	35·10	27·22	86	2575	—	—	—	—	—
50	9·21	35·14	27·22	87	4630	9·01	35·10	27·22	87	4305	—	—	—	—	—
70	9·12	35·14	27·23	87	6370	9·01	35·10	27·22	87	6045	—	—	—	—	—
100	8·93	35·14	27·27	84	8935	9·02	35·10	27·22	88	8670	—	—	—	—	—
120	—	—	—	—	—	9·02	35·10	27·22	88	10430	—	—	—	—	—
140	8·72	35·14	27·31	82	12255	—	—	—	—	—	—	—	—	—	—

Station Sc. 16*a*.

Latitude, 61° 49′ N. ; Longitude, 5° 36′ W.

Depth (Metres).	Temp. °C.	S.°/∞	σt.	v—v′.	e—e′.	Temp. °C.	S.°/∞	σt.	v—v′.	e—e′.	Temp. °C.	S.°/∞	σt.	v—v′.	e—e′.
	8th July, 1907.					10th April, 1908.					9th June, 1908.				
0	8·35	35·17	27·38	72	0	6·05	35·12	27·66	43	0	7·85	35·19	27·46	64	0
10	8·52	35·14	27·31	76	740	5·99	35·08	27·64	46	445	7·86	35·19	27·46	64	640
20	8·52	35·12	27·30	78	1510	5·92	35·08	27·65	45	900	7·79	35·19	27·47	63	1275
30	8·50	35·14	27·32	76	2280	5·89	35·08	27·65	45	1350	7·63	35·19	27·49	64	1910
40	8·49	35·14	27·33	77	3045	—	—	—	—	—	—	—	—	—	—
50	—	—	—	—	—	5·82	35·08	27·66	44	2240	7·42	35·19	27·53	58	3130
60	8·14	35·14	27·38	72	4535	—	—	—	—	—	—	—	—	—	—
70	—	—	—	—	—	5·82	35·08	27·66	44	3120	6·96	35·14	27·56	56	4270
80	7·49	35·17	27·50	62	5875	—	—	—	—	—	—	—	—	—	—
100	7·26	35·16	27·52	60	7895	5·83	35·10	27·68	44	4440	6·80	35·17	27·59	51	5875
150	7·13	35·16	27·54	58	10045	5·83	35·10	27·68	45	6665	—	—	—	—	—
170	—	—	—	—	—	5·85	35·10	27·68	45	7565	—	—	—	—	—
190	—	—	—	—	—	—	—	—	—	—	6·42	35·17	27·65	49	10375
240	6·94	35·16	27·57	58	15265	—	—	—	—	—	—	—	—	—	—

Depth (Metres).	Temp. °C.	S.°/∞	σt.	v—v′.	e—e′.	Temp. °C.	S.°/∞	σt.	v—v′.	e—e′.	Temp. °C.	S.°/∞	σt.	v—v′.	e—e′.
	21st August, 1908.					7th November, 1908.					—				
0	10·85	35·16	26·94	113	0	8·76	35·16	27·30	79	0	—	—	—	—	—
10	10·71	35·14	26·96	111	1120	8·98	35·16	27·26	82	805	—	—	—	—	—
20	10·61	35·14	26·98	109	2220	8·98	35·16	27·26	82	1625	—	—	—	—	—
30	10·19	35·14	27·05	102	3275	8·98	35·16	27·26	82	2445	—	—	—	—	—
50	9·50	35·14	27·17	92	5215	8·98	25·16	27·26	83	4095	—	—	—	—	—
70	8·81	35·19	27·32	78	6915	8·98	35·16	27·26	83	5755	—	—	—	—	—
100	8·21	35·19	27·41	70	9135	8·89	35·19	27·30	80	8200	—	—	—	—	—
150	7·81	35·19	27·47	65	12510	8·76	35·19	27·32	78	12150	—	—	—	—	—
200	7·72	35·19	27·48	65	15760	—	—	—	—	—	—	—	—	—	—
213	—	—	—	—	—	8·73	35·19	27·33	78	17064	—	—	—	—	—

Station Sc. 17.

Latitude, 61° 11′ N. ; Longitude, 6° 33″ W.

Depth (Metres).	Temp. °C.	S.°/∞	σt.	v—v′.	e—e′.	Temp. °C.	S.°/∞	σt.	v—v′.	e—e′.	Temp. °C.	S.°/∞	σt.	v—v′.	e—e′.
	10th July, 1907.					13th April, 1908.					13th June, 1908.				
0	8·45	35·23	27·40	68	0	7·25	35·25	27·59	51	0	7·25	35·16	27·52	56	0
10	8·51	35·19	27·36	72	700	7·28	35·17	27·54	55	530	7·09	35·12	27·52	58	570
20	8·40	35·19	27·38	71	1415	6·78	35·12	27·56	53	1070	7·02	35·12	27·52	58	1150
30	8·16	35·23	27·44	64	2090	6·62	35·12	27·58	50	1585	7·06	35·10	27·51	58	1730
40	7·92	35·23	27·49	62	2720	—	—	—	—	—	—	—	—	—	—
50	—	—	—	—	—	6·42	35·08	27·58	52	2605	7·03	35·14	27·54	56	2870
60	7·80	35·21	27·49	61	3950	—	—	—	—	—	—	—	—	—	—
70	—	—	—	—	—	6·41	35·10	27·60	52	3645	7·05	35·16	27·55	54	3970
80	7·79	35·21	27·49	62	5180	—	—	—	—	—	—	—	—	—	—
100	7·79	35·21	27·49	62	6420	6·40	35·10	27·60	52	5205	7·05	35·16	27·55	55	5605
120	—	—	—	—	—	6·41	35·12	27·61	50	6225	—	—	—	—	—
130	—	—	—	—	—	—	—	—	—	—	7·09	35·16	27·55	56	7270
145	7·75	35·21	27·50	62	9210	—	—	—	—	—	—	—	—	—	—

STATION SC. 17—*continued.*

Latitude, 61° 11′ N. ; Longitude, 6° 33′ W.—*continued.*

Depth (Metres).	Temp. °C.	S.°/oo	σt.	$v—v^2$	e—e′.	Temp. °C.	S.°/oo	σt.	v—v′.	e—e′.	Temp. °C.	S.°/oo	σt.	v—v′.	e—e′.
	9th November, 1908.					—					—				
0	8·85	35·19	27·32	78	0	—	—	—	—	—	—	—	—	—	—
10	8·92	35·19	27·31	78	780	—	—	—	—	—	—	—	—	—	—
20	8·90	35·19	27·31	78	1560	—	—	—	—	—	—	—	—	—	—
30	8·84	35·19	27·32	78	2340	—	—	—	—	—	—	—	—	—	—
50	8·80	35·19	27·32	77	3890	—	—	—	—	—	—	—	—	—	—
70	8·80	35·19	27·32	77	5430	—	—	—	—	—	—	—	—	—	—
100	8·76	35·19	27·33	77	7740	—	—	—	—	—	—	—	—	—	—
115	8·76	35·19	27·33	77	8895	—	—	—	—	—	—	—	—	—	—

STATION SC. 18*a*.

Latitude, 60° 57′ N. ; Longitude, 5° 47′ W.

	10th July, 1907.					13th April, 1908.					13th June, 1908.				
0	9·55	35·35	27·32	76	0	6·55	35·16	27·63	48	0	8·25	35·23	27·43	65	0
10	9·40	35·19	27·22	86	810	6·49	35·08	27·57	52	500	8·29	35·25	27·43	65	650
20	9·36	35·17	27·22	87	1675	6·39	35·08	27·58	51	1015	8·12	35·19	27·42	66	1305
30	9·23	35·17	27·24	85	2535	6·29	35·08	27·60	49	1515	8·06	35·19	27·43	65	1960
40	8·89	35·21	27·32	77	3345	—	—	—	—	—	—	—	—	—	—
50	—	—	—	—	—	6·28	35·08	27·60	50	2505	7·99	35·23	27·47	63	3240
60	8·81	35·19	27·32	77	4885	—	—	—	—	—	—	—	—	—	—
70	—	—	—	—	—	6·26	35·08	27·60	50	3505	8·00	35·23	27·47	63	4500
80	8·13	35·19	27·42	69	6345	—	—	—	—	—	—	—	—	—	—
100	7·74	35·17	27·47	64	7675	6·19	35·08	27·61	50	5005	7·01	35·21	27·61	51	6210
150	7·40	35·17	27·51	62	10825	6·13	35·08	27·62	51	7530	—	—	—	—	—
200	7·04	35·17	27·58	58	13825	6·01	35·12	27·67	47	9955	6·74	35·16	27·60	53	11410
250	6·84	35·17	27·60	54	16625	5·72	34·92	27·55	59	12605	—	—	—	—	—
300	6·67	35·17	27·62	53	19300	—	—	—	—	—	6·24	35·21	27·72	44	16260

	9th November, 1908.					—					—				
0	8·95	35·12	27·24	84	0	—	—	—	—	—	—	—	—	—	—
10	9·09	35·16	27·24	83	835	—	—	—	—	—	—	—	—	—	—
20	9·09	35·16	27·24	83	1665	—	—	—	—	—	—	—	—	—	—
30	9·09	35·16	27·24	83	2495	—	—	—	—	—	—	—	—	—	—
50	9·09	35·16	27·24	84	4165	—	—	—	—	—	—	—	—	—	—
70	9·09	35·16	27·24	84	5845	—	—	—	—	—	—	—	—	—	—
100	8·93	35·25	27·44	75	8230	—	—	—	—	—	—	—	—	—	—
200	8·34	35·28	27·46	66	14830	—	—	—	—	—	—	—	—	—	—
295	7·87	35·28	27·54	62	20910	—	—	—	—	—	—	—	—	—	—

STATION SC. 19*a*.

Latitude, 60° 36′ N. ; Longitude, 4° 46′ W.

	10th July, 1907.					13th April, 1908.					13th June, 1908.				
0	9·75	35·37	27·31	78	0	7·55	35·23	27·55	55	0	9·15	35·21	27·29	79	0
10	9·80	35·37	27·30	79	785	7·62	35·26	27·56	54	545	9·34	35·23	27·26	81	800
20	9·84	35·28	27·27	80	1580	7·55	35·26	27·58	54	1085	8·88	35·14	27·27	82	1615
30	—	—	—	—	—	7·48	35·25	27·57	54	1625	8·42	35·14	27·35	75	2400
40	9·11	35·28	27·33	76	3140	—	—	—	—	—	—	—	—	—	—
50	—	—	—	—	—	7·48	35·25	27·57	55	2715	7·80	35·14	27·44	67	3820
60	8·43	35·26	27·44	67	4570	—	—	—	—	—	—	—	—	—	—
70	—	—	—	—	—	7·48	35·21	27·54	57	3835	7·51	35·21	27·53	57	5060
80	8·24	35·26	27·46	65	5890	—	—	—	—	—	—	—	—	—	—
100	8·13	35·26	27·48	64	7180	7·49	35·21	27·54	58	5560	7·19	35·19	27·57	56	6755
150	7·52	35·21	27·53	60	10280	—	—	—	—	—	—	—	—	—	—
200	7·51	35·23	27·53	60	13280	7·42	35·21	27·55	59	11410	6·70	35·19	27·63	49	12005
300	6·48	35·17	27·65	51	18830	7·15	35·21	27·59	58	17260	3·84	35·01	27·74	30	15955
400	4·44	35·03	27·79	36	23180	5·35	35·08	27·72	45	22410	1·50	34·85	27·90	22	18555
500	1·03	34·85	27·94	19	25930	1·91	34·87	27·90	24	25860	0·24	34·88	28·02	11	20205
600	−0·07	34·94	27·12	2	26980	—	—	—	—	—	−0·16	34·88	28·04	9	21205
700	—	—	—	—	—	−0·13	34·87	28·03	7	28960	−0·47	34·90	28·07	4	21855
800	−0·57	34·94	27·11	0	27180	—	—	—	—	—	−0·69	34·92	28·10	2	22155
900	—	—	—	—	—	—	—	—	—	—	−0·87	34·94	28·13	−1	22205
950	−0·78	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1000	—	—	—	—	—	−0·36	34·87	28·00	6	30910	−0·97	34·94	28·13	−2	22055

Station Sc. 19a—*continued.*

Latitude, 60° 36′ N.; Longitude, 4° 46′ W.—*continued.*

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′.	e—e′.	Temp. °C.	S.°/₀₀	σt.	v—v′.	e—e′.	Temp. °C.	S.°/₀₀	σt.	v—v′.	e—e′.
	24th August, 1908.					10 November, 1908.					—				
0	11·05	35·19	26·93	114	0	9·45	35·21	27·23	84	0	—	—	—	—	—
10	11·00	35·16	26·91	114	1140	9·44	35·21	27·23	84	840	—	—	—	—	—
20	10·12	35·01	26·96	110	2260	9·44	35·21	27·23	84	1680	—	—	—	—	—
30	10·01	35·07	27·02	104	3330	9·40	35·23	27·25	83	2515	—	—	—	—	—
50	9·67	35·12	27·12	97	5340	9·22	35·23	27·28	81	4155	—	—	—	—	—
70	8·49	35·17	27·36	75	7060	9·22	35·28	27·32	77	5735	—	—	—	—	—
100	8·03	35·25	27·48	63	9130	8·93	35·32	27·40	70	7940	—	—	—	—	—
200	7·57	35·19	27·50	63	15430	8·01	35·32	27·54	59	14390	—	—	—	—	—
300	7·11	35·17	27·57	58	21480	6·85	35·23	27·65	53	19990	—	—	—	—	—
400	5·33	35·07	27·71	44	26580	3·93	34·97	27·80	35	24390	—	—	—	—	—
500	1·83	34·90	27·95	22	29880	1·15	34·82	27·99	13	26790	—	—	—	—	—
600	−0·26	34·90	28·06	6	31280	0·02	34·97	28·11	2	27540	—	—	—	—	—
700	−0·76	34·90	28·09	3	31730	—	—	—	—	—	—	—	—	—	—
800	−0·94	35·01	28·19	2	31980	−0·49	34·99	28·15	−2	27540	—	—	—	—	—
900	−1·06	34·90	28·11	0	32080	—	—	—	—	—	—	—	—	—	—
1000	−1·07	Contents lost.		0	32080	−0·86	34·99	28·17	−4	26940	—	—	—	—	—

Station Sc. 19b.

Latitude, 60° 23′ N.; Longitude, 4° 6′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′.	e—e′.	Temp. °C.	S.°/₀₀	σt.	v—v′.	e—e′.	Temp. °C.	S.°/₀₀	σt.	v—v′.	e—e′.
	11th July, 1907.					14th April, 1908.					14th June, 1908.				
0	9·55	35·37	27·35	75	0	8·05	35·26	27·49	60	0	9·55	35·26	27·24	84	0
10	9·61	35·26	27·25	84	795	8·18	35·26	27·47	62	610	9·69	35·28	27·24	84	840
20	9·42	35·28	27·29	80	1615	8·18	35·26	27·47	62	1230	9·69	35·30	27·26	82	1670
30	—	—	—	—	—	8·18	35·26	27·47	62	1850	9·68	35·37	27·32	77	2465
40	9·22	35·28	27·32	78	3195	—	—	—	—	—	—	—	—	—	—
50	—	—	—	—	—	8·18	35·26	27·47	62	3100	9·59	35·30	27·27	82	4055
60	8·89	35·30	27·39	70	4675	—	—	—	—	—	—	—	—	—	—
70	—	—	—	—	—	8·18	35·26	27·47	62	4360	9·22	35·30	27·34	76	5635
80	8·80	35·30	27·40	70	6070	—	—	—	—	—	—	—	—	—	—
100	8·53	35·30	27·45	67	7445	8·19	35·28	27·48	61	6250	9·13	35·30	27·35	75	7900
200	7·82	35·23	27·50	63	13945	8·16	35·28	27·49	61	12650	8·98	35·30	27·37	75	15400
300	7·15	35·19	27·57	60	20095	—	—	—	—	—	8·81	35·30	27·41	75	22900
350	—	—	—	—	—	—	—	—	—	—	9·14	35·34	27·38	76	26700
400	6·25	35·17	27·68	49	25545	8·02	35·28	27·51	58	25750	—	—	—	—	—
500	6·14	35·10	27·64	55	30745	—	—	—	—	—	—	—	—	—	—
600	—	—	—	—	—	6·58	35·12	27·59	50	38450	—	—	—	—	—
	10th November, 1908.					—					—				
0	9·65	35·19	27·17	91	0	—	—	—	—	—	—	—	—	—	—
10	9·78	35·16	27·13	94	925	—	—	—	—	—	—	—	—	—	—
20	9·76	35·16	27·13	94	1865	—	—	—	—	—	—	—	—	—	—
30	9·76	35·16	27·13	94	2805	—	—	—	—	—	—	—	—	—	—
50	9·76	35·16	27·13	95	4695	—	—	—	—	—	—	—	—	—	—
70	9·71	35·16	27·14	94	6585	—	—	—	—	—	—	—	—	—	—
100	9·52	35·16	27·17	92	9375	—	—	—	—	—	—	—	—	—	—
200	9·20	35·26	27·32	81	18025	—	—	—	—	—	—	—	—	—	—
300	8·35	35·21	27·41	73	25725	—	—	—	—	—	—	—	—	—	—
400	7·72	35·21	27·51	66	32675	—	—	—	—	—	—	—	—	—	—
500	5·16	35·03	27·70	47	38325	—	—	—	—	—	—	—	—	—	—

Station Sc. 20a.

Latitude, 60° 17′ N.; Longitude, 3° 52′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀	σt.	v—v′.	e—e′.	Temp. °C.	S.°/₀₀	σt.	v—v′.	e—e′.	Temp. °C.	S.°/₀₀	σt.	v—v′.	e—e′.
	11th July, 1907.					14th April, 1908.					10th November, 1908.				
0	10·45	35·34	27·15	92	0	8·05	35·30	27·52	57	0	10·95	35·12	26·91	115	0
10	10·45	35·28	27·10	97	945	8·10	35·26	27·48	61	590	11·10	35·14	26·89	117	1160
20	10·45	35·32	27·13	91	1900	8·10	35·26	27·48	61	1200	11·10	35·14	26·89	117	2330
30	—	—	—	—	—	8·10	35·26	27·48	61	1810	11·10	35·14	26·89	117	3500
40	10·26	35·32	27·18	91	3750	—	—	—	—	—	—	—	—	—	—
50	—	—	—	—	—	8·05	35·26	27·49	62	3040	11·10	35·14	26·89	118	5850
60	9·82	35·34	27·27	83	5490	—	—	—	—	—	—	—	—	—	—
70	—	—	—	—	—	8·00	35·26	27·50	62	4280	11·10	35·17	26·91	116	8190
80	9·42	35·32	27·32	79	7110	—	—	—	—	—	—	—	—	—	—
100	9·21	35·32	27·35	75	8650	8·01	35·26	27·50	62	6140	10·99	35·25	26·98	111	11595
170	9·12	35·34	27·38	75	13900	7·97	35·26	27·50	63	10515	—	—	—	—	—
200	—	—	—	—	—	—	—	—	—	—	10·57	35·25	27·06	105	22395

STATION SC. 21.

Latitude, 59° 46′ N.; Longitude, 2° 21′ W.

Depth (Metres).	Temp. °C.	S.‰	σt.	v—v′.	e—e′.	Temp. °C.	S.‰	σt.	v—v′.	e—e′.	Temp. °C.	S.‰	σt.	v—v′.	e—e′.
	13th July, 1907.					14th April, 1908.					10th November, 1908.				
0	9·85	35·25	27·18	89	0	7·05	35·05	27·46	62	0	10·35	34·99	26·91	117	0
10	9·75	35·21	27·19	90	895	6·82	35·05	27·50	58	600	10·52	35·03	26·90	116	1165
20	9·18	35·23	27·29	79	1740	6·70	35·08	27·54	55	1165	10·51	35·05	26·91	114	2315
30	8·72	35·26	27·39	71	2490	6·70	35·08	27·54	55	1715	10·50	35·12	26·97	108	3425
50	8·64	35·26	27·40	70	3900	6·71	35·08	27·54	56	2825	10·30	35·12	27·01	106	5565
70	8·64	35·26	27·40	70	5300	6·71	35·08	27·54	56	3945	10·00	35·21	27·14	96	7585
85	—	—	—	—	—	6·71	35·10	27·56	56	4785	—	—	—	—	—
95	8·65	35·26	27·40	71	7063	—	—	—	—	—	—	—	—	—	—
105	—	—	—	—	—	—	—	—	—	—	9·90	35·25	27·18	92	9935

STATION SC. 21*a*.

Latitude, 60° 2′ N.; Longitude, 3° 10′ W.

Depth (Metres).	Temp. °C.	S.‰	σt.	v—v′.	e—e′.	Temp. °C.	S.‰	σt.	v—v′.	e—e′.	Temp. °C.	S.‰	σt.	v—v′.	e—e′.
	11th July, 1907.					14th April, 1908.					10th November, 1908.				
0	9·85	34·96	26·96	110	0	7·75	35·28	27·55	55	0	10·75	35·01	26·85	122	0
10	9·85	34·94	26·95	111	1105	7·66	35·26	27·55	55	550	10·80	34·97	26·82	125	1235
20	9·82	34·94	26·97	111	2215	7·61	35·26	27·56	54	1095	10·80	34·97	26·82	125	2485
30	9·49	34·94	27·01	106	3300	7·61	35·26	27·56	54	1635	10·80	34·97	26·82	125	3735
50	8·88	35·07	27·21	88	5240	7·61	35·26	27·56	55	2725	10·80	35·03	26·86	122	6205
70	8·73	35·16	27·30	79	6910	7·61	35·26	27·56	56	3835	—	—	—	—	—
75	—	—	—	—	—	—	—	—	—	—	10·80	35·03	26·86	122	9255
90	8·70	35·21	27·35	76	8460	—	—	—	—	—	—	—	—	—	—
100	—	—	—	—	—	7·61	35·26	27·56	56	5515	—	—	—	—	—
150	—	—	—	—	—	7·54	35·26	27·57	55	8290	—	—	—	—	—
200	—	—	—	—	—	7·48	35·26	27·58	56	11065	—	—	—	—	—

STATION SC. 22.

Latitude, 59° 36′ N.; Longitude, 0° 41′ W.

Depth (Metres).	Temp. °C.	S.‰	σt.	v—v′.	e—e′.	Temp. °C.	S.‰	σt.	v—v′.	e—e′.	Temp. °C.	S.‰	σt.	v—v′.	e—e′.
	13th February, 1907.					10th May, 1907.					7th August, 1907.				
0	6·15	35·23	27·74	37	0	7·05	35·22	27·62	50	0	11·55	35·19	26·83	121	0
10	6·39	35·19	27·67	42	395	6·98	35·22	27·62	49	495	11·41	35·19	26·86	118	1195
20	6·39	35·16	27·64	44	825	6·95	35·24	27·64	47	975	11·09	35·19	26·92	113	2350
30	6·39	35·17	27·64	44	1265	6·92	35·28	27·67	44	1430	10·88	35·23	26·99	106	3445
40	6·39	35·17	27·66	45	1710	6·85	35·24	27·65	47	1885	8·18	35·25	27·46	64	4295
60	6·40	35·17	27·66	45	2610	6·99	35·26	27·64	47	2825	7·22	35·28	27·63	50	5435
80	6·42	35·21	27·69	43	3490	6·60	35·26	27·69	42	3715	6·89	35·28	27·67	45	6385
100	—	—	—	—	—	6·60	35·27	27·71	41	4545	6·59	35·28	27·72	40	7235
115	6·42	35·21	27·69	43	4995	—	—	—	—	—	—	—	—	—	—
125	—	—	—	—	—	—	—	—	—	—	6·49	35·32	27·76	36	8185
132	—	—	—	—	—	6·60	35·20	27·65	46	5937	—	—	—	—	—
	12th March, 1908.					15th September, 1908.					12th November, 1908.				
0	7·05	34·87	27·33	73	0	11·75	34·88	26·56	150	0	9·70	35·16	27·15	93	0
10	7·09	34·83	27·30	81	770	11·70	34·85	26·54	150	1500	9·60	35·16	27·16	91	920
20	—	—	—	—	—	11·60	34·85	26·56	148	2990	9·60	35·19	27·19	89	1820
30	7·12	34·83	27·29	82	2400	11·38	34·97	26·70	135	4405	9·60	35·19	27·19	89	2710
50	—	—	—	—	—	8·85	35·19	27·31	77	6525	9·60	35·19	27·19	90	4500
60	7·15	34·85	27·30	79	4815	—	—	—	—	—	—	—	—	—	—
70	—	—	—	—	—	8·71	35·19	27·33	75	8045	9·60	35·19	27·19	90	6300
80	7·12	34·85	27·30	79	6395	—	—	—	—	—	—	—	—	—	—
100	6·87	34·81	27·31	81	7995	7·31	35·19	27·54	55	10000	8·15	35·23	27·45	68	8670
120	6·81	34·81	27·33	80	10410	—	—	—	—	—	—	—	—	—	—
130	—	—	—	—	—	7·32	35·19	27·54	57	11700	7·81	35·23	27·50	61	10600

STATION SC. 23.

Latitude, 59° 31′ N. ; Longitude, 0° 37′ E.

Depth (Metres).	Temp. °C.	S.°/₀₀.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/₀₀.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/₀₀.	σt.	v—v′.	e—e′.
	24th February, 1907.					26th May, 1907.					1st September, 1907.				
0	5·55	35·18	27·78	53	0	7·65	35·20	27·50	59	0	10·95	35·19	26·96	110	0
10	5·63	35·17	27·74	35	340	7·72	35·20	27·50	60	595	11·01	35·10	26·88	119	1145
20	5·63	35·18	27·78	34	685	7·08	35·20	27·59	52	1155	11·01	35·12	26·89	117	2325
30	5·63	35·17	27·74	35	1030	6·96	35·22	27·62	48	1655	11·01	35·12	26·89	117	3495
40	5·63	35·15	27·73	36	1385	6·86	35·22	27·64	47	2130	10·99	35·16	26·92	114	4650
50	—	—	—	—	—	—	—	—	—	—	7·69	35·17	27·47	63	5535
60	5·63	35·17	27·74	35	2095	6·09	35·21	27·73	39	2990	6·52	35·19	27·65	45	6075
80	5·63	35·13	27·72	39	2835	6·09	35·22	27·74	39	3770	6·19	35·23	27·72	39	6915
100	5·64	35·17	27·74	36	3585	6·09	35·22	27·74	39	4550	6·19	35·23	27·72	39	7695
120	—	—	—	—	—	—	—	—	—	—	6·19	35·26	27·75	36	8445
125	—	—	—	—	—	6·09	35·22	27·74	39	5525	—	—	—	—	—
138	5·66	35·11	27·71	41	5048	—	—	—	—	—	—	—	—	—	—
	29th November, 1907.					15th March, 1908.					3rd July, 1908.				
0	7·55	35·26	27·56	53	0	6·05	35·14	27·68	42	0	12·45	35·21	26·69	137	0
10	7·51	35·23	27·54	55	540	6·19	35·14	27·66	44	430	12·42	35·19	26·67	138	1375
20	7·82	35·19	27·47	63	1130	—	—	—	—	—	10·62	35·16	26·98	108	2600
30	—	—	—	—	—	6·18	35·14	27·66	44	1310	9·88	35·17	27·12	96	3625
40	7·85	35·17	27·45	66	2420	—	—	—	—	—	—	—	—	—	—
50	—	—	—	—	—	—	—	—	—	—	6·79	35·19	27·62	48	5065
60	7·85	35·19	27·46	64	3720	6·14	35·14	27·67	44	2630	—	—	—	—	—
70	—	—	—	—	—	—	—	—	—	—	6·41	35·19	27·67	44	5985
80	6·57	35·25	27·69	42	4780	6·14	35·14	27·67	44	3510	—	—	—	—	—
100	—	—	—	—	—	6·15	35·16	27·67	44	4390	6·40	35·19	27·67	45	7320
118	6·51	35·25	27·70	42	6376	—	—	—	—	—	—	—	—	—	—
120	—	—	—	—	—	6·16	35·16	27·67	45	5280	—	—	—	—	—
135	—	—	—	—	—	—	—	—	—	—	6·40	35·21	27·69	43	8860
	25th September, 1908.					—					—				
0	11·75	34·65	26·38	165	0	—	—	—	—	—	—	—	—	—	—
10	11·73	34·65	26·39	157	1610	—	—	—	—	—	—	—	—	—	—
20	11·71	34·65	26·39	157	3180	—	—	—	—	—	—	—	—	—	—
30	10·87	34·85	26·69	134	7545	—	—	—	—	—	—	—	—	—	—
40	6·88	35·28	27·67	42	9305	—	—	—	—	—	—	—	—	—	—
50	6·71	35·23	27·66	45	9740	—	—	—	—	—	—	—	—	—	—
70	6·59	35·23	27·67	43	10600	—	—	—	—	—	—	—	—	—	—
100	6·56	35·21	27·67	45	10900	—	—	—	—	—	—	—	—	—	—
120	6·45	35·21	27·68	44	12800	—	—	—	—	—	—	—	—	—	—

STATION SC. 24.

Latitude, 58° 55′ N. ; Longitude, 0° 4′ E.

Depth (Metres).	Temp. °C.	S.°/₀₀.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/₀₀.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/₀₀.	σt.	v—v′.	e—e′.
	24th February, 1907.					26th May, 1907.					1st September, 1907.				
0	5·65	35·20	27·79	33	0	7·65	35·20	27·50	59	0	10·65	35·25	27·04	101	0
10	5·79	35·11	27·69	41	370	7·72	35·20	27·49	60	595	10·88	35·16	26·92	111	1060
20	5·79	35·11	27·69	41	780	7·56	35·17	27·50	61	1200	10·88	35·17	26·94	110	2165
30	5·79	35·13	27·70	40	1185	7·28	35·20	27·55	55	1780	10·88	35·19	26·95	109	3260
40	5·79	35·13	27·70	40	1585	6·82	35·20	27·63	48	2295	10·86	35·23	27·00	107	4340
50	—	—	—	—	—	—	—	—	—	—	9·82	35·23	27·17	91	5330
60	5·79	35·17	27·72	37	2355	6·32	35·20	27·69	43	3205	7·26	35·23	27·58	53	6050
80	5·79	35·17	27·72	37	3095	6·21	35·20	27 70	42	4055	6·73	35·26	27·68	44	7020
100	5·79	35·17	27·72	38	3845	6·20	35·18	27·70	43	4905	6·63	35·23	27·68	45	7910
115	—	—	—	—	—	—	—	—	—	—	6·37	35·26	27·73	40	8543
135	—	—	—	—	—	6·19	35·20	27·71	42	6393	—	—	—	—	—
138	5·79	35·17	27·72	38	5289	—	—	—	—	—	—	—	—	—	—
	29th November, 1907.					15th March, 1908.					3rd July, 1908.				
0	7·50	35·25	27·55	54	0	6·05	35·25	27·75	34	0	12·45	35·10	26·60	144	0
10	7·79	35·21	27·49	61	575	6·22	35·01	27·56	54	440	12·39	35·10	26 61	144	1440
20	7·79	35·21	27·49	61	1185	—	—	—	—	—	10·11	35·10	27·03	104	2680
30	—	—	—	—	—	6·22	35·14	27·66	44	1420	8·06	35·10	27·36	72	3560
40	7·79	35·19	27·47	63	2425	—	—	—	—	—	—	—	—	—	—
50	—	—	—	—	—	—	—	—	—	—	6·39	35·12	27·61	50	4780
60	7·79	35·17	27·46	64	3695	6·22	35·23	27·72	38	2650	—	—	—	—	—
70	—	—	—	—	—	—	—	—	—	—	6·39	35·12	27·61	51	5790
80	7·80	35·17	27·46	66	4995	6·22	35·14	27·66	45	3480	—	—	—	—	—
100	6·55	35·21	27·66	45	6105	6·23	35·14	27·66	46	4390	6·39	35·21	27·69	44	7215
120	—	—	—	—	—	—	—	—	—	—	6·39	35·21	27·69	44	8100
135	—	—	—	—	—	6·23	35·14	27·66	46	6000	—	—	—	—	—
140	6·50	35·23	27·68	43	7865	—	—	—	—	—	—	—	—	—	—

STATION SC. 24—*continued*.

Latitude, 58° 55′ N.; Longitude, 0° 4′ E.—*continued*.

Depth (Metres).	Temp. °C.	S.‰	σt.	v—v′.	e—e′.	Temp. °C.	S.‰	σt.	v—v′.	e—e′.	Temp. °C.	S.‰	σt.	v—v′.	e—e′.
	25th September, 1908.					—					—				
0	11·75	35·12	26·75	130	0	—	—	—	—	—	—	—	—	—	—
10	11·70	35·10	26·75	131	1305	—	—	—	—	—	—	—	—	—	—
20	11·53	35·19	26·84	120	2560	—	—	—	—	—	—	—	—	—	—
30	10·25	35·19	27·07	99	3655	—	—	—	—	—	—	—	—	—	—
40	9·47	35·23	27·24	86	4580	—	—	—	—	—	—	—	—	—	—
50	7·63	35·23	27·52	57	5295	—	—	—	—	—	—	—	—	—	—
70	7·01	35·19	27·59	53	6395	—	—	—	—	—	—	—	—	—	—
100	6·83	35·19	27·62	51	7955	—	—	—	—	—	—	—	—	—	—
120	6·79	35·19	27·62	51	8975	—	—	—	—	—	—	—	—	—	—

STATION SC. 25.

Latitude, 58° 11′ N.; Longitude, 0° 32′ W.

Depth (Metres).	Temp. °C.	S.‰	σt.	v—v′.	e—e′.	Temp. °C.	S.‰	σt.	v—v′.	e—e′.	Temp. °C.	S.‰	σt.	v—v′.	e—e′.
	25th February, 1907.					27th May, 1907.					2nd September, 1907.				
0	6·05	35·20	27·73	38	0	8·45	35·26	27·43	66	0	10·65	35·25	27·04	102	0
10	6·15	35·18	27·70	40	390	8·51	35·27	27·43	67	665	10·55	35·25	27·06	100	1010
20	6·15	35·20	27·71	39	785	7·80	35·26	27·54	57	1285	10·55	35·21	27·04	103	2025
30	6·15	35·20	27·71	39	1175	7·80	35·24	27·52	59	1865	10·55	35·23	27·05	101	3040
40	6·15	35·20	27·71	40	1570	7·59	35·24	27·54	57	2445	10·55	35·26	27·08	100	4045
50	—	—	—	—	—	6·82	35·22	27·65	48	2970	—	—	—	—	—
60	6·15	35·20	27·71	40	2370	—	—	—	—	—	8·60	35·26	27·41	69	5735
70	—	—	—	—	—	6·80	35·22	27·65	47	3920	—	—	—	—	—
80	6·15	35·20	27·71	41	3180	—	—	—	—	—	8·27	35·30	27·48	63	7055
90	—	—	—	—	—	6·80	35·24	27·66	47	4860	—	—	—	—	—
100	—	—	—	—	—	—	—	—	—	—	8·23	35·35	27·53	59	8275
104	6·15	35·20	27·71	41	4164	—	—	—	—	—	—	—	—	—	—
	29th November, 1907.					16th March, 1908.					3rd July, 1908.				
0	8·25	35·28	27·47	62	0	6·15	35·19	27·71	40	0	12·55	35·03	26·52	152	0
10	8·38	35·21	27·40	69	655	6·42	35·08	27·58	51	455	12·49	34·97	26·49	156	1540
20	8·38	35·21	27·40	69	1345	—	—	—	—	—	9·25	34·99	27·09	99	7815
30	—	—	—	—	—	6·42	35·10	27·60	50	960	6·82	35·08	27·53	57	8595
40	8·38	35·23	27·41	69	2725	—	—	—	—	—	—	—	—	—	—
50	—	—	—	—	—	—	—	—	—	—	6·62	35·12	27·59	52	9685
60	8·38	35·23	27·41	69	4105	6·46	35·17	27·65	47	2415	—	—	—	—	—
70	—	—	—	—	—	—	—	—	—	—	6·63	35·08	27·56	56	10765
80	8·33	35·25	27·43	67	5465	6·46	35·10	27·59	52	3405	—	—	—	—	—
98	—	—	—	—	—	—	—	—	—	—	6·63	35·08	27·56	56	11906
110	—	—	—	—	—	6·47	35·10	27·59	53	4455	—	—	—	—	—
120	7·41	35·30	27·62	51	7825	—	—	—	—	—	—	—	—	—	—
	26th September, 1908.					—					—				
0	11·35	35·19	26·87	118	0	—	—	—	—	—	—	—	—	—	—
10	11·33	35·17	26·87	120	1190	—	—	—	—	—	—	—	—	—	—
20	11·25	35·17	26·88	119	2385	—	—	—	—	—	—	—	—	—	—
30	11·25	35·21	26·91	115	3555	—	—	—	—	—	—	—	—	—	—
50	11·10	35·21	26·94	113	5835	—	—	—	—	—	—	—	—	—	—
70	9·23	35·21	27·27	84	7805	—	—	—	—	—	—	—	—	—	—
100	8·61	35·21	27·37	74	10175	—	—	—	—	—	—	—	—	—	—

STATION SC. 26.

Latitude, 58° 9′ N.; Longitude 1° 50′ W.

Depth (Metres).	Temp. °C.	S.‰	σt.	v—v′.	e—e′.	Temp. °C.	S.‰	σt.	v—v′.	e—e′.	Temp. °C.	S.‰	σt.	v—v′.	e—e′.
	27th January, 1907.					12th February, 1907.					9th May, 1907.				
0	6·65	35·25	27·68	40	0	5·85	34·91	27·53	57	0	7·35	34·93	27·35	76	0
10	6·85	35·16	27·58	51	455	6·02	34·88	27·48	62	595	7·40	34·91	27·32	78	770
20	6·85	35·17	27·60	50	960	6·02	34·89	27·49	61	1210	7·00	34·97	27·41	68	1500
30	6·85	35·25	27·65	44	1430	6·02	34·88	27·48	62	1825	6·90	35·06	27·49	59	2135
40	6·85	35·19	27·61	50	1900	—	—	—	—	—	6·88	35·09	27·52	58	2720
50	—	—	—	—	—	6·02	34·86	27·46	64	3085	—	—	—	—	—
64	—	—	—	—	—	—	—	—	—	—	6·88	35·09	27·52	58	4112
66	6·85	35·21	27·63	49	3187	—	—	—	—	—	—	—	—	—	—
78	—	—	—	—	—	6·02	34·89	27·49	62	4849	—	—	—	—	—

Station Sc. 26—*continued.*

Latitude, 58° 9′ N. ; Longitude, 1° 50′ W.—*continued.*

Depth (Metres).	Temp. °C.	S.‰	σt.	v—v′.	e—e′.	Temp. °C.	S.‰	σt.	v—v′.	e—e′.	Temp. °C.	S.‰	σt.	v—v′.	e—e′.
	4th July, 1905.					6th August, 1907.					21st August, 1907.				
0	9·85	34·99	26·98	108	0	10·95	35·10	26·89	117	0	10·55	35·05	26·90	115	0
10	9·78	34·97	26·98	108	1080	10·78	34·92	26·77	128	1225	10·49	35·03	26·91	115	1150
20	9·34	34·97	27·06	102	2130	10·42	35·05	26·93	113	2430	10·48	35·03	26·91	115	2300
30	9·29	34·99	27·08	100	3140	10·58	35·19	27·01	104	3515	10·32	35·03	26·94	113	3440
40	9·28	34·99	27·08	101	4145	—	—	—	—	—	10·32	35·01	26·93	115	4580
50	9·52	35·07	27·11	98	5140	9·61	35·19	27·19	90	5455	—	—	—	—	—
60	—	—	—	—	—	—	—	—	—	—	10·12	35·03	26·97	108	6810
70	—	—	—	—	—	8·90	35·25	27·35	74	7095	—	—	—	—	—
72	9·19	35·03	27·13	96	7274	—	—	—	—	—	—	—	—	—	—
80	—	—	—	—	—	—	—	—	—	—	10·08	35·10	27·04	105	8940
85	—	—	—	—	—	8·89	35·25	27·35	75	8213	—	—	—	—	—

Depth (Metres).	Temp. °C.	S.‰	σt.	v—v′.	e—e′.	Temp. °C.	S.‰	σt.	v—v′.	e—e′.	Temp. °C.	S.‰	σt.	v—v′.	e—e′.
	15th November, 1907.					11th March, 1908.					3rd June, 1908.				
0	9·95	34·88	26·89	117	0	6·15	34·31	27·01	107	0	9·35	34·63	26·80	126	0
10	9·98	34·83	26·84	122	1195	6·28	34·42	27·07	99	1030	9·12	34·70	26·89	117	1215
20	9·99	34·83	26·84	122	2415	6·32	34·43	27·08	98	2015	7·81	34·83	27·19	88	2240
30	10·00	34·88	26·88	119	3620	6·32	34·45	27·09	98	2995	7·00	34·97	27·42	67	3115
40	10·00	34·90	26·90	118	4805	—	—	—	—	—	—	—	—	—	—
50	—	—	—	—	—	6·51	34·61	27·20	99	4985	6·82	35·01	27·48	62	4405
60	10·00	34·90	26·90	118	7165	—	—	—	—	—	—	—	—	—	—
70	—	—	—	—	—	—	—	—	—	—	6·82	35·03	27·49	61	5635
80	10·00	34·90	26·90	119	9535	—	—	—	—	—	—	—	—	—	—
88	—	—	—	—	—	—	—	—	—	—	6·82	35·03	27·49	61	6733

Depth (Metres).	Temp. °C.	S.‰	σt.	v—v′.	e—e′.	Temp. °C.	S.‰	σt.	v—v′.	e—e′.	Temp. °C.	S.‰	σt.	v—v′.	e—e′.
	20th June, 1908.					6th August, 1908.					14th September, 1908.				
0	9·05	34·87	27·03	105	0	12·05	34·96	26·56	148	0	10·85	34·96	26·79	126	0
10	9·18	34·83	26·98	109	1070	11·84	34·96	26·61	144	1460	10·80	35·01	26·85	122	1240
20	8·31	34·83	27·11	96	2095	11·40	34·90	26·64	140	2880	10·80	35·01	26·85	122	2460
30	7·80	34·87	27·22	87	3010	10·56	34·90	26·79	126	4210	10·80	35·01	26·85	122	3680
50	7·39	34·87	27·28	81	4690	10·11	34·96	26·92	109	6560	—	—	—	—	—
55	—	—	—	—	—	—	—	—	—	—	10·80	35·01	26·85	123	6740
65	—	—	—	—	—	9·79	34·99	27·00	108	8185	—	—	—	—	—
70	7·31	34·88	27·30	79	6290	—	—	—	—	—	—	—	—	—	—
88	7·21	35·01	27·42	68	7613	—	—	—	—	—	—	—	—	—	—

Depth (Metres).	Temp. °C.	S.‰	σt.	v—v′.	e—e′.	Temp. °C.	S.‰	σt.	v—v′.	e—e′.	Temp. °C.	S.‰	σt.	v—v′.	e—e′.
	4th November, 1908.					—					—				
0	10·65	34·85	26·73	131	0	—	—	—	—	—	—	—	—	—	—
10	10·71	34·83	26·71	133	1320	—	—	—	—	—	—	—	—	—	—
20	10·71	34·85	26·72	132	2640	—	—	—	—	—	—	—	—	—	—
30	10·70	34·94	26·80	125	3925	—	—	—	—	—	—	—	—	—	—
50	10·61	35·07	26·92	115	6325	—	—	—	—	—	—	—	—	—	—
70	10·62	35·07	26·92	115	8625	—	—	—	—	—	—	—	—	—	—
85	10·62	35·07	26·62	116	10355	—	—	—	—	—	—	—	—	—	—

Station Sc. 27.

Latitude, 57° 31′ N. ; Longitude, 1° 12′ W.

Depth (Metres).	Temp. °C.	S.‰	σt.	v—v′.	e—e′.	Temp. °C.	S.‰	σt.	v—v′.	e—e′.	Temp. °C.	S.‰	σt.	v—v′.	e—e′.
	25th February, 1907.					27th May, 1907.					16th March, 1908.				
0	5·85	35·00	27·60	50	0	8·05	34·95	27·26	83	0	5·55	34·65	27·36	73	0
10	5·72	35·00	27·62	49	495	7·75	34·95	27·30	79	810	5·62	34·65	27·34	73	730
20	5·72	35·02	27·62	48	980	7·20	34·93	27·36	73	1570	—	—	—	—	—
30	5·72	35·00	27·64	49	1465	7·19	34·93	27·36	73	2300	5·80	34·69	27·34	73	2190
40	—	—	—	—	—	7·19	34·93	27·36	74	3035	—	—	—	—	—
50	5·71	35·00	27·63	50	2455	7·18	34·91	27·36	75	3780	6·00	34·79	27·41	69	3610
70	5·70	35·00	27·63	50	3455	7·16	34·93	27·37	73	5260	6·02	34·79	27·41	69	4990
90	5·59	35·00	27·63	48	4435	—	—	—	—	—	—	—	—	—	—
95	—	—	—	—	—	—	—	—	—	—	6·13	34·79	27·39	70	6727
96	—	—	—	—	—	7·16	34·88	27·33	78	7223	—	—	—	—	—
120	5·59	35·00	27·63	49	5890	—	—	—	—	—	—	—	—	—	—

Station Sc. 27—*continued.*

Latitude, 57° 31′ N. ; Longitude, 1° 12′ W.—*continued.*

Depth (Metres).	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′
	23rd July, 1908.					26th September, 1908.					—				
0	12·15	34·29	26·03	199	0	11·85	34·42	26·18	183	0	—	—	—	—	—
10	11·84	34·70	26·42	162	1805	11·75	34·52	26·29	174	1785	—	—	—	—	—
20	11·08	34·70	26·55	150	3365	11·49	34·81	26·56	151	3410	—	—	—	—	—
30	9·15	34·70	26·88	118	4705	11·10	34·96	26·74	131	4820	—	—	—	—	—
50	8·95	34·70	26·92	116	7045	11·00	35·01	26·81	128	7410	—	—	—	—	—
70	8·55	34·72	26·99	109	9295	10·86	35·05	26·86	121	9900	—	—	—	—	—
90	—	—	—	—	—	10·69	35·08	26·91	116	12270	—	—	—	—	—
100	8·42	34·76	27·04	105	12505	—	—	—	—	—	—	—	—	—	—
115	8·34	34·76	27·05	104	14070	—	—	—	—	—	—	—	—	—	—

Station Sc. 28.

Latitude, 57° 53′ N. ; Longitude, 3° 48′ W.

Depth (Metres).	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′
	8th February, 1907.					8th April, 1907.					22nd July, 1907.				
0	4·25	34·11	27·09	107	0	5·75	34·35	27·11	97	0	12·05	34·29	26·05	197	0
10	4·62	34·43	27·28	79	930	5·79	34·41	27·14	93	950	12·99	34·22	25·80	220	2085
24	5·32	34·70	27·41	67	1952	—	—	—	—	—	—	—	—	—	—
25	—	—	—	—	—	5·48	34·50	27·24	83	2270	—	—	—	—	—
27	—	—	—	—	—	—	—	—	—	—	10·02	34·90	26·90	117	4100
	12th September, 1907.					8th November, 1907.					14th January, 1908.				
0	12·35	34·65	26·28	175	0	9·05	34·43	26·68	137	0	5·25	33·96	26·83	121	0
5	12·00	34·69	26·36	166	853	—	—	—	—	—	5·45	34·13	26·94	111	580
10	11·18	34·78	26·59	144	1628	9·14	34·47	26·70	135	1360	5·90	34·47	27·18	90	1082
15	11·00	34·83	26·66	139	2336	—	—	—	—	—	—	—	—	—	—
20	11·00	34·87	26·69	135	3021	9·38	34·52	26·70	135	2710	—	—	—	—	—
25	—	—	—	—	—	—	—	—	—	—	6·81	34·81	27·33	76	2327
	17th February, 1908.					23rd April, 1908.					24th July, 1908.				
0	5·15	33·66	26·61	142	0	5·85	33·95	26·76	130	0	12·65	34·58	26·15	186	0
5	5·19	33·69	26·64	141	705	—	—	—	—	—	—	—	—	—	—
10	5·38	34·09	26·92	112	1325	5·99	33·86	26·67	136	1330	12·76	34·60	26·14	187	1865
20	5·72	34·56	27·26	82	1810	6·12	34·20	26·92	113	2580	11·21	34·60	26·44	159	3595
	10th October, 1908.					1st December, 1908.					—				
0	11·95	33·98	25·83	218	0	7·45	30·81	25·09	—	—	—	—	—	—	—
10	11·90	33·98	25·84	217	2175	8·89	34·65	26·87	118	—	—	—	—	—	—
20	—	—	—	—	—	9·21	34·70	26·88	119	1185	—	—	—	—	—
25	11·40	34·78	26·55	149	4920	—	—	—	—	—	—	—	—	—	—

Station Sc. 30.

Latitude, 58° N. ; Longitude, 2° 54′ W.

Depth (Metres).	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′
	7th February, 1907.					8th April, 1907.					22nd July, 1907.				
0	5·85	34·94	27·55	55	0	6·50	34·98	27·58	60	0	12·05	35·07	26·65	139	0
10	5·92	34·92	27·52	57	560	6·10	34·91	27·50	60	600	12·00	34·96	26·57	146	1425
20	5·92	34·92	27·52	57	1130	6·09	34·95	27·53	57	1185	10·08	34·96	26·92	114	2725
30	5·92	34·94	27·54	55	1690	6·08	34·95	27·53	57	1755	9·79	34·96	26·97	109	3840
48	—	—	—	—	—	6·08	34·98	27·56	56	2772	—	—	—	—	—
55	5·92	34·96	27·55	54	3053	—	—	—	—	—	9·78	34·99	27·01	108	6553
	12th September, 1907.					8th November, 1907.					14th January, 1908.				
0	11·45	34·83	26·58	147	0	9·95	34·70	26·75	131	0	6·85	34·76	27·28	81	0
10	10·78	34·83	26·69	135	1410	10·11	34·70	26·72	134	1325	6·80	34·78	27·30	79	800
20	10·78	34·88	26·73	131	2740	10·15	34·70	26·70	134	2665	6·79	34·78	27·30	79	1590
30	10·75	34·83	26·70	135	4070	10·15	34·70	26·70	134	4035	6·78	34·78	27·30	79	2380
45	10·75	34·83	26·70	136	6103	10·18	34·76	26·75	131	5993	—	—	—	—	—
50	—	—	—	—	—	—	—	—	—	—	6·75	34·85	27·35	74	3910

Station Sc. 30—*continued*.

Latitude, 58° N. ; Longitude, 2° 54′ W.—*continued*.

Depth (Metres).	Temp. °C.	S.°/₀₀.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/₀₀.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/₀₀.	σt.	v—v′.	e—e′.
	17th February, 1908.					23rd April, 1908.					24th July, 1908.				
0	5·85	34·61	27·30	79	0	6·25	34·74	27·34	74	0	11·85	34·72	26·41	160	0
10	6·09	34·67	27·30	78	785	6·28	34·69	27·28	79	765	10·89	34·67	26·55	148	1540
20	6·09	34·67	27·30	78	1565	6·29	34·69	27·28	79	1555	10·60	34·74	26·66	138	2970
30	6·09	34·65	27·28	79	2350	6·29	34·70	27·30	79	2345	10·50	34·74	26·68	134	4330
40	6·09	34·65	27·28	79	3410	—	—	—	—	—	—	—	—	—	—
45	—	—	—	—	—	6·31	34·74	27·33	75	3500	—	—	—	—	—
50	6·09	34·65	27·28	80	3935	—	—	—	—	—	10·50	34·85	26·76	130	6970
68	—	—	—	—	—	—	—	—	—	—	10·23	34·83	26·80	126	9274
	9th October, 1908.					2nd December, 1908.					—				
0	11·35	34·90	26·66	139	0	9·25	34·76	26·91	116	0	—	—	—	—	—
10	11·38	34·92	26·67	139	1390	9·32	34·76	26·90	116	1160	—	—	—	—	—
20	11·38	34·92	26·67	139	2780	9·32	34·76	26·90	116	2320	—	—	—	—	—
30	11·38	34·94	26·69	137	4160	9·32	34·76	26·90	116	3480	—	—	—	—	—
50	—	—	—	—	—	9·32	34·76	26·90	117	5810	—	—	—	—	—
55	11·38	34·94	26·69	138	7598	—	—	—	—	—	—	—	—	—	—

Station Sc. 32.

Latitude, 58° 8′ N. ; Longitude, 2° 0′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/₀₀.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/₀₀.	σt.	v—v′.	e—e′.
	7th February, 1907.					8th April, 1907.					22nd July, 1907.				
0	5·95	34·88	27·49	60	0	6·25	34·89	27·46	63	0	11·05	35·17	26·92	114	0
10	6·19	34·88	27·45	63	615	6·26	34·91	27·48	62	625	11·24	35·16	26·86	118	1160
20	6·19	34·88	27·45	63	1215	6·21	34·88	27·45	63	1250	9·31	35·16	27·21	87	2185
30	6·19	34·85	27·43	65	1885	6·19	34·86	27·43	64	1885	9·31	35·16	27·21	87	3055
40	6·19	34·85	27·43	66	2540	6·19	34·88	27·45	64	2525	—	—	—	—	—
50	—	—	—	—	—	—	—	—	—	—	9·06	35·17	27·27	83	4755
60	—	—	—	—	—	6·19	35·06	27·59	50	3665	—	—	—	—	—
65	6·19	34·83	27·42	68	4215	—	—	—	—	—	—	—	—	—	—
70	—	—	—	—	—	—	—	—	—	—	9·06	35·19	27·28	82	6405
84	—	—	—	—	—	6·19	35·08	27·61	50	4865	—	—	—	—	—
	12th September, 1907.					8th November, 1907.					14th January, 1908.				
0	10·85	35·01	26·83	123	0	10·05	34·83	26·82	122	0	7·05	34·79	27·22	81	0
10	10·73	34·99	26·84	122	1225	10·20	34·83	26·80	125	1235	7·21	34·76	27·22	86	835
20	10·60	34·99	26·85	120	2435	10·20	34·83	26·80	125	2485	7·21	34·76	27·22	86	1695
30	10·55	35·07	26·92	113	3600	10·20	34·83	26·80	125	3735	7·22	34·76	27·22	86	2555
40	—	—	—	—	—	10·20	34·83	26·80	126	4990	—	—	—	—	—
50	10·20	35·08	27·00	108	5810	10·20	34·83	26·80	126	6250	7·24	34·76	27·21	87	4285
60	10·00	35·08	27·03	104	6870	—	—	—	—	—	—	—	—	—	—
65	—	—	—	—	—	—	—	—	—	—	7·25	34·78	27·23	85	5575
70	7·21	35·12	27·50	61	7695	10·16	34·83	26·81	125	8760	—	—	—	—	—
90	7·16	35·12	27·51	61	8915	—	—	—	—	—	—	—	—	—	—
	17th February, 1908.					23rd April, 1908.					24th July, 1908.				
0	6·45	34·83	27·39	70	0	6·05	34·83	27·44	65	0	11·55	34·72	26·48	156	0
10	6·79	34·72	27·24	83	765	6·31	34·83	27·40	69	670	11·00	34·69	26·55	149	1525
20	6·79	34·72	27·24	83	1595	6·39	34·83	27·39	70	1365	10·50	34·69	26·63	141	2975
30	6·79	34·72	27·24	83	2425	6·41	34·88	27·45	66	2045	10·42	34·74	26·70	135	4355
40	6·79	34·72	27·24	83	3255	—	—	—	—	—	—	—	—	—	—
50	6·79	34·74	27·26	83	4085	6·41	34·90	27·45	66	3365	10·19	34·83	26·81	126	6965
60	—	—	—	—	—	6·48	34·99	27·50	61	4000	10·06	34·83	26·83	124	8215
70	6·80	34·74	27·26	83	4915	—	—	—	—	—	—	—	—	—	—
	9th October, 1908.					2nd December 1908.					—				
0	11·35	34·94	26·68	136	0	9·55	34·78	26·88	119	0	—	—	—	—	—
10	11·32	34·94	26·69	136	1360	9·59	34·74	26·84	122	1205	—	—	—	—	—
20	11·30	34·99	26·73	132	2700	9·59	34·74	26·84	122	2425	—	—	—	—	—
30	11·20	35·07	26·81	124	3980	9·59	34·74	26·84	122	3645	—	—	—	—	—
50	10·80	35·17	26·97	111	6330	9·59	34·74	26·84	123	6095	—	—	—	—	—
70	10·81	35·21	27·00	109	8530	9·59	34·74	26·84	123	8555	—	—	—	—	—
78	—	—	—	—	—	9·59	34·79	26·88	120	10742	—	—	—	—	—
90	10·81	35·21	27·00	109	10710	—	—	—	—	—	—	—	—	—	—

Station Sc. 34.

Latitude, 58° 17′ N. ; Longitude, 1° 3′ W.

Depth (Metres).	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′.
	7th February, 1907.					8th April, 1907.					26th June, 1907.				
0	6·25	35·12	27·64	46	0	6·15	35·16	27·71	42	0	10·75	35·25	27·03	104	0
10	6·80	35·12	27·55	54	500	6·16	35·14	27·79	44	430	—	—	—	—	—
20	6·81	35·10	27·54	56	1050	6·16	35·16	27·80	42	860	—	—	—	—	—
30	6·85	35·12	27·55	55	1605	6·16	35·17	27·82	41	1275	—	—	—	—	—
40	6·85	35·19	27·61	50	2130	—	—	—	—	—	—	—	—	—	—
50	—	—	—	—	—	6·16	35·17	27·82	42	2105	—	—	—	—	—
51	—	—	—	—	—	—	—	—	—	—	7·49	35·23	27·54	57	4106
60	6·85	35·14	27·57	54	3170	—	—	—	—	—	—	—	—	—	—
70	—	—	—	—	—	6·16	35·17	27·82	42	2945	—	—	—	—	—
80	6·86	35·16	27·58	53	4240	—	—	—	—	—	—	—	—	—	—
94	—	—	—	—	—	6·16	35·21	27·85	40	3929	—	—	—	—	—
102	—	—	—	—	—	—	—	—	—	—	7·41	35·23	27·56	57	7013
112	6·87	35·16	27·58	53	5936	—	—	—	—	—	—	—	—	—	—

Depth (Metres).	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′.
	23rd July, 1907					12th September, 1907.					7th and 8th November, 1907.				
0	11·45	35·28	26·92	113	0	10·65	35·17	26·99	107	0	9·95	34·96	26·95	112	0
10	11·61	35·23	26·86	119	1160	10·55	35·14	26·96	110	1085	10·08	34·96	26·91	114	1130
20	11·31	35·28	26·95	110	2305	10·65	35·12	26·94	111	2190	10·08	34·92	26·88	117	2285
30	9·08	35·28	27·35	74	3225	10·62	35·12	26·95	111	3300	10·09	34·97	26·93	114	3440
40	—	—	—	—	—	10·10	35·12	27·05	101	4360	—	—	—	—	—
50	7·82	35·28	27·54	57	4535	10·05	35·21	27·12	96	5345	10·09	34·97	26·93	115	5730
60	—	—	—	—	—	7·00	35·21	27·61	51	6080	—	—	—	—	—
70	7·65	35·28	27·55	54	5645	—	—	—	—	—	10·10	35·03	26·97	110	7980
80	—	—	—	—	—	6·79	35·25	27·65	46	7050	—	—	—	—	—
94	7·63	35·28	27·56	55	6953	—	—	—	—	—	—	—	—	—	—
95	—	—	—	—	—	—	—	—	—	—	10·10	35·03	26·97	111	10743
105	—	—	—	—	—	6·76	35·25	27·66	46	8200	—	—	—	—	—

Depth (Metres).	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′.
	20th January, 1908.					20th February, 1908.					24th April, 1908.				
0	7·65	35·07	27·41	67	0	6·85	34·94	27·42	67	0	6·05	35·16	27·68	40	0
10	7·71	34·97	27·32	77	720	6·81	34·88	27·37	71	690	6·35	35·16	27·64	44	420
20	7·72	34·97	27·32	77	1490	6·81	34·88	27·37	71	1400	6·40	35·16	27·64	45	920
30	—	—	—	—	—	6·81	34·88	27·37	71	2110	6·40	35·16	27·64	45	1370
40	7·72	34·99	27·33	76	3020	6·82	34·88	27·37	71	2820	—	—	—	—	—
50	—	—	—	—	—	6·82	34·92	27·40	69	3520	6·40	35·16	27·64	46	2280
60	7·74	35·01	27·34	75	4530	—	—	—	—	—	—	—	—	—	—
70	—	—	—	—	—	6·89	34·99	27·44	66	4870	6·40	35·16	27·64	46	3200
80	7·75	35·01	27·34	75	6030	—	—	—	—	—	—	—	—	—	—
90	—	—	—	—	—	6·89	35·03	27·47	63	6160	6·40	35·16	27·64	46	4120
100	7·79	35·01	27·34	77	7550	—	—	—	—	—	—	—	—	—	—

Depth (Metres).	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′.
	26th July, 1908.					9th October, 1908.					2nd December, 1908.				
0	12·55	34·99	26·50	153	0	11·45	35·12	26·80	124	0	9·55	35·08	27·10	96	0
10	12·52	35·01	26·52	152	1525	11·31	35·12	26·83	123	1235	9·52	35·08	27·11	95	955
20	11·11	35·05	26·81	124	2905	11·28	35·16	26·87	120	2450	9·52	35·08	27·11	95	1905
30	8·48	35·10	27·31	79	4420	11·22	35·16	26·88	118	3640	9·51	35·08	27·11	95	2855
50	8·12	35·21	27·44	65	5860	11·12	35·16	26·90	117	5990	9·46	35·10	27·14	95	3805
70	7·46	35·17	27·51	60	7110	10·01	35·23	27·15	94	8100	9·42	35·12	27·16	92	5675
95	—	—	—	—	—	—	—	—	—	—	9·39	35·12	27·16	92	7975
100	—	—	—	—	—	9·43	35·23	27·25	85	10785	—	—	—	—	—
105	7·11	35·14	27·53	57	9158	—	—	—	—	—	—	—	—	—	—

Station Sc. 36.

Latitude, 58° 26′ N. ; Longitude, 0° 8′ W.

Depth (Metres).	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′.
	7th February, 1907.					9th April, 1907.					23rd July, 1907.				
0	6·45	35·19	27·70	43	0	6·25	35·17	27·69	43	0	11·45	35·17	26·87	121	0
10	6·72	35·19	27·62	47	450	5·80	35·10	27·68	42	425	11·48	35·08	26·77	128	1245
20	6·72	35·19	27·62	47	920	5·80	35·12	27·69	40	835	11·42	35·10	26·80	126	2515
30	6·72	35·17	27·61	48	1395	5·80	35·18	27·75	36	1215	8·61	35·16	27·32	75	3520
40	—	—	—	—	—	5·80	35·12	27·69	41	1600	7·56	35·16	27·48	62	4205
50	6·72	35·21	27·64	47	2345	—	—	—	—	—	—	—	—	—	—
60	—	—	—	—	—	5·80	35·16	27·72	39	2400	6·61	35·17	27·63	48	5305
70	6·73	35·23	27·65	45	3265	—	—	—	—	—	—	—	—	—	—
80	—	—	—	—	—	5·80	35·19	27·75	37	3160	6·27	35·17	27·68	45	6235
90	6·73	35·19	27·62	49	4205	—	—	—	—	—	—	—	—	—	—
100	—	—	—	—	—	5·80	35·19	27·75	37	3900	6·23	35·19	27·69	43	7115
120	—	—	—	—	—	5·80	35·21	27·77	36	4630	—	—	—	—	—
123	6·74	35·19	27·62	49	5842	—	—	—	—	—	—	—	—	—	—
130	—	—	—	—	—	—	—	—	—	—	6·23	35·19	27·69	43	8405

STATION Sc. 36—*continued.*

Latitude, 58° 26′ N.; Longitude, 0° 8′ W.—*continued.*

Depth (Metres).	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′.
	11th September, 1907.					7th November, 1907.					20th February, 1908.				
0	10·65	35·23	27·03	102	0	9·35	35·19	27·23	85	0	6·75	35·21	27·64	46	0
10	10·80	35·16	26·96	111	1065	9·52	35·19	27·21	88	865	6·70	35·19	27·63	47	465
20	10·70	35·16	26·97	109	2165	9·51	35·23	27·24	85	1730	6·70	35·19	27·63	47	935
30	10·62	35·16	26·98	107	3245	9·49	35·23	27·24	84	2575	6·70	35·19	27·63	47	1405
40	10·50	35·17	27·02	106	4310	9·48	35·23	27·24	85	3420	6·70	35·19	27·63	47	1875
50	9·50	35·17	27·19	90	5290	—	—	—	—	—	—	—	—	—	—
60	8·38	35·21	27·40	69	6085	8·64	35·26	27·39	69	4960	6·70	35·19	27·63	48	2825
80	6·99	35·28	27·66	46	7235	8·02	35·26	27·50	62	6270	6·71	35·21	27·65	47	3775
100	6·83	35·28	27·69	45	8145	7·61	35·28	27·67	55	7440	6·71	35·21	27·65	48	4725
120	6·83	35·28	27·69	45	9045	—	—	—	—	—	—	—	—	—	—
125	—	—	—	—	—	7·61	35·28	27·67	55	8815	—	—	—	—	—
130	—	—	—	—	—	—	—	—	—	—	6·71	35·21	27·65	48	6165
	24th April, 1908.					26th July, 1908.					9th October, 1908.				
0	5·75	35·17	27·74	36	0	13·05	34·92	26·34	169	0	12·05	35·05	26·64	141	0
10	6·20	35·16	27·66	43	395	13·06	34·92	26·34	169	1690	11·98	35·07	26·66	139	1400
20	6·28	35·16	27·65	44	830	13·00	34·94	26·37	167	3370	11·92	35·07	26·67	137	2780
30	6·28	35·25	27·72	37	1235	10·15	35·08	27·00	105	4730	11·89	35·07	26·68	137	4150
40	—	—	—	—	—	—	—	—	—	—	11·39	35·07	26·77	129	5480
50	6·28	35·16	27·65	45	2055	6·58	35·14	27·62	50	6280	7·50	35·16	27·48	61	6430
70	6·28	35·16	27·65	45	2955	6·61	35·14	27·61	50	7280	7·01	35·17	27·56	53	7570
100	6·29	35·16	27·65	46	4320	6·57	35·14	27·62	51	8795	6·69	35·17	27·61	50	9115
130	6·29	35·16	27·65	46	5700	—	—	—	—	—	—	—	—	—	—
135	—	—	—	—	—	6·48	35·17	27·65	48	10527	6·66	35·21	27·65	47	10812
	2nd December, 1908.					—					—				
0	8·75	35·19	27·32	75	0	—	—	—	—	—	—	—	—	—	—
10	8·69	35·19	27·33	75	750	—	—	—	—	—	—	—	—	—	—
20	8·69	35·19	27·33	75	1500	—	—	—	—	—	—	—	—	—	—
30	8·69	35·19	27·33	75	2250	—	—	—	—	—	—	—	—	—	—
50	8·68	35·19	27·34	76	3760	—	—	—	—	—	—	—	—	—	—
70	8·66	35·21	27·36	74	5260	—	—	—	—	—	—	—	—	—	—
100	8·56	35·23	27·38	71	7435	—	—	—	—	—	—	—	—	—	—
120	8·30	35·25	27·43	66	8805	—	—	—	—	—	—	—	—	—	—

STATION Sc. 38.

Latitude, 58° 34′ N.; Longitude, 0° 47′ E.

Depth (Metres).	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′.
	7th February, 1907.					9th April, 1907.					23rd July, 1907.				
0	6·05	35·19	27·72	38	0	5·65	35·16	27·74	36	0	11·35	35·25	26·92	113	0
10	6·28	35·24	27·73	37	375	5·69	35·21	27·78	32	340	11·44	35·12	26·80	125	1190
20	6·30	35·25	27·73	37	745	5·69	35·19	27·76	34	670	11·44	35·16	26·83	122	2425
30	6·30	35·19	27·68	42	1140	5·69	35·17	27·75	35	1015	11·44	35·19	26·86	119	3630
40	6·30	35·21	27·70	41	1555	5·69	35·17	27·75	35	1365	8·38	35·16	27·35	73	4590
60	6·30	35·23	27·71	39	2355	5·69	35·17	27·75	36	2075	6·90	35·21	27·62	49	5810
80	6·31	35·17	27·67	45	3195	5·69	35·16	27·73	37	2805	6·42	35·21	27·69	44	6740
100	—	—	—	—	—	5·69	35·14	27·73	39	3565	6·33	35·21	27·70	42	7600
110	6·32	35·24	27·72	40	4470	—	—	—	—	—	—	—	—	—	—
132	—	—	—	—	—	5·69	35·19	27·77	36	4765	—	—	—	—	—
150	—	—	—	—	—	—	—	—	—	—	6·31	35·23	27·71	40	9650
	11th September, 1907.					7th November, 1907.					20th February, 1908.				
0	11·45	35·22	26·77	117	0	9·35	35·16	27·21	87	0	6·55	35·12	27·57	50	0
10	11·33	35·22	26·82	115	1160	9·45	35·12	27·15	92	895	6·56	35·08	27·54	54	520
20	—	—	—	—	—	9·45	35·12	27·15	92	1815	6·56	35·08	27·54	54	1040
30	11·22	35·08	26·82	124	3550	9·45	35·12	27·15	92	2735	6·54	35·08	27·54	53	1575
40	11·15	35·05	26·80	126	4800	9·45	35·16	27·18	90	3645	6·54	35·08	27·54	53	2105
50	—	—	—	—	—	9·45	35·17	27·20	90	4545	—	—	—	—	—
60	7·15	35·25	27·61	50	6560	7·48	35·25	27·55	54	5265	6·54	35·10	27·56	52	3155
80	7·01	35·25	27·63	49	7550	6·45	35·19	27·66	46	6265	6·59	35·10	27·57	53	4205
100	6·81	35·25	27·66	47	8510	6·41	35·21	27·69	45	7175	6·63	35·14	27·60	51	5245
135	—	—	—	—	—	6·40	35·23	27·70	43	8715	—	—	—	—	—
140	6·67	35·25	27·67	45	10350	—	—	—	—	—	6·64	35·16	27·61	50	7265

Station Sc. 38.—*continued.*

Latitude, 58° 34′ N. ; Longitude, 0° 47′ E.—*continued.*

Depth (Metres).	Temp. °C.	S.‰.	σt.	v—v′.	e—e′.	Temp. °C.	S.‰.	σt.	v—v′.	e—e′.	Temp. °C.	S.‰.	σt.	v—v′.	e—e′.
	24th April, 1908.					26th July, 1908.					9th October, 1908.				
0	6·15	35·03	27·58	52	0	13·85	34·87	26·14	188	0	12·15	35·03	26·60	145	0
10	6·19	35·03	27·57	53	525	13·62	34·87	26·18	184	1860	12·10	35·03	26·61	144	1445
20	6·19	35·03	27·57	53	1055	11·98	34·94	26·56	148	3520	12·10	35·03	26·61	144	2885
30	6·19	35·03	27·57	53	1585	10·02	34·97	26·96	112	4820	12·10	35·03	26·61	144	4325
40	—	—	—	—	—	—	—	—	—	—	12·10	35·03	26·61	144	5765
50	6·21	35·07	27·60	50	2615	6·61	34·97	27·48	63	6570	8·40	35·03	27·26	84	6905
70	6·22	35·07	27·60	50	3615	6·51	35·03	27·53	58	7780	7·13	35·12	27·51	58	8325
100	6·20	35·12	27·64	48	5085	6·50	35·03	27·53	59	9535	6·81	35·12	27·56	55	10020
140	6·21	35·14	27·66	46	6965	6·50	35·08	27·57	55	11815	6·82	35·12	27·56	55	12220
	2nd December, 1908.					—					—				
0	9·05	35·08	27·20	88	0	—	—	—	—	—	—	—	—	—	—
10	9·04	35·08	27·19	88	880	—	—	—	—	—	—	—	—	—	—
20	9·04	35·08	27·19	88	1760	—	—	—	—	—	—	—	—	—	—
30	9·02	35·08	27·20	88	2640	—	—	—	—	—	—	—	—	—	—
50	8·99	35·08	27·20	88	4400	—	—	—	—	—	—	—	—	—	—
70	8·88	35·08	27·22	88	6160	—	—	—	—	—	—	—	—	—	—
100	8·73	35·08	27·25	89	8815	—	—	—	—	—	—	—	—	—	—
120	8·09	35·08	27·34	76	10465	—	—	—	—	—	—	—	—	—	—
140	7·85	35·08	27·38	73	11955	—	—	—	—	—	—	—	—	—	—

Station Sc. 38*a*.

Latitude, 58° 42′ N. ; Longitude, 1° 44′ E.

Depth (Metres).	Temp. °C.	S.‰.	σt.	v—v′.	e—e′.	Temp. °C.	S.‰.	σt.	v—v′.	e—e′.	Temp. °C.	S.‰.	σt.	v—v′.	e—e′.
	9th April, 1907.					11th September, 1907.					7th November, 1907.				
0	5·85	35·17	27·74	38	0	11·40	34·79	26·56	148	0	9·55	35·19	27·21	88	0
10	5·92	35·17	27·72	39	385	11·25	34·79	26·59	146	1470	9·58	35·19	27·19	89	885
20	5·92	35·17	27·72	39	775	11·21	34·81	26·62	144	2920	9·58	35·19	27·19	89	1775
30	5·92	35·19	27·73	37	1155	10·88	34·96	26·78	127	4275	9·58	35·19	27·19	89	2665
40	5·92	35·19	27·73	37	1525	—	—	—	—	—	9·58	35·19	27·19	90	3560
50	—	—	—	—	—	10·15	34·99	26·95	113	6675	—	—	—	—	—
60	5·89	35·19	27·73	38	2275	7·52	35·23	27·55	56	7520	8·80	35·19	27·32	78	5240
80	5·89	35·19	27·73	38	3035	6·86	35·23	27·64	49	8570	7·22	35·21	27·58	55	6570
100	5·89	35·21	27·75	37	3785	6·81	35·23	27·65	48	9540	7·21	35·21	27·58	55	7670
122	5·89	35·25	27·77	34	11595	—	—	—	—	—	—	—	—	—	—
140	—	—	—	—	—	6·81	35·23	27·65	48	11460	—	—	—	—	—
	26th July, 1908.					8th October, 1908.					3rd December, 1908.				
0	13·70	34·81	26·12	190	0	12·05	35·12	26·69	135	0	8·85	35·08	27·22	86	0
10	13·69	34·81	26·12	190	1900	12·00	35·12	26·70	135	1350	9·07	35·08	27·19	89	875
20	12·32	34·81	26·40	163	3665	12·00	35·12	26·70	135	2700	9·07	35·08	27·19	89	1765
30	9·70	34·85	26·90	115	5055	12·00	35·12	26·70	135	4050	9·07	35·08	27·19	89	2655
40	—	—	—	—	—	11·99	35·12	26·70	135	5400	—	—	—	—	—
50	6·90	34·90	27·38	78	6985	7·72	34·97	27·32	81	6500	9·07	bottle	broken	89	3545
70	6·62	34·94	27·45	65	8415	6·82	35·05	27·50	59	7900	8·88	35·08	27·22	87	5305
100	—	—	—	—	—	6·81	35·07	27·52	59	9670	8·21	35·08	27·33	78	7780
110	6·51	34·97	27·49	63	10975	—	—	—	—	—	—	—	—	—	—

Station Sc. 39*b*.

Latitude, 57° 59′ N. ; Longitude, 0° 57′ E.

Depth (Metres).	Temp. °C.	S.‰.	σt.	v—v′.	e—e′.	Temp. °C.	S.‰.	σt.	v—v′.	e—e′.	Temp. °C.	S.‰.	σt.	v—v′.	e—e′.
	6th February, 1907.					10th April, 1907.					23rd July, 1907.				
0	6·05	35·21	27·74	37	0	5·85	35·21	27·77	34	0	11·45	35·19	26·88	120	0
10	6·35	35·19	27·77	42	395	5·91	35·17	27·72	38	360	11·75	35·12	26·75	130	1250
20	6·35	35·19	27·77	42	815	5·91	35·19	27·73	36	730	11·62	35·12	26·79	127	2535
30	6·35	35·19	27·77	42	1235	5·91	35·19	27·73	36	1090	8·61	35·17	27·34	75	3545
40	6·35	35·19	27·77	43	1660	5·91	35·17	27·72	38	1460	7·81	35·21	27·49	61	4225
60	6·35	35·17	27·76	45	2540	5·91	35·23	27·76	34	2180	6·35	35·21	27·68	42	5255
80	6·36	35·21	27·79	43	3420	5·90	35·25	27·77	33	2850	6·23	35·21	27·69	42	6095
100	6·37	35·23	27·80	42	4270	5·88	35·25	27·77	33	3510	6·20	35·21	27·71	41	6925
150	—	—	—	—	—	—	—	—	—	—	6·20	35·21	27·71	41	8975
152	6·38	35·21	27·79	43	6480	—	—	—	—	—	—	—	—	—	—
155	—	—	—	—	—	5·80	35·16	27·72	40	5518	—	—	—	—	—

Station Sc. 39*b*—*continued*.

Latitude, 57° 59′ N. ; Longitude, 0° 57′ E.—*continued*.

Depth (Metres).	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′.
	11th September, 1907.					7th November, 1907.					14th February, 1908.				
0	11·25	35·17	26·88	117	0	9·25	35·12	27·19	89	0	6·75	35·08	27·54	56	0
10	11·50	35·14	26·82	124	1205	9·45	35·14	27·17	90	895	6·88	35·03	27·47	62	590
20	11·43	35·16	26·83	122	2435	9·45	35·14	27·17	90	1795	6·88	35·05	27·48	60	1200
30	—	—	—	—	—	9·45	35·14	27·17	90	2695	6·88	35·08	27·51	58	1790
40	11·18	35·17	26·90	117	4825	9·45	35·17	27·20	89	3590	6·88	35·08	27·51	58	2370
50	11·18	35·28	26·98	109	5955	—	—	—	—	—	—	—	—	—	—
60	7·45	35·30	27·61	50	6750	9·45	35·19	27·21	88	5360	6·90	35·08	27·51	59	3540
70	—	—	—	—	—	7·21	35·19	27·56	55	6075	—	—	—	—	—
80	7·16	35·30	27·66	47	7720	6·81	35·19	27·62	51	6605	6·91	35·08	27·51	59	4720
100	7·01	35·30	27·67	45	8640	6·56	35·23	27·67	44	7555	6·91	35·08	27·51	60	5910
140	—	—	—	—	—	—	—	—	—	—	6·90	35·08	27·51	60	8310
145	—	—	—	—	—	6·51	35·23	27·68	43	9513	—	—	—	—	—
150	6·88	35·26	27·67	47	10940	—	—	—	—	—	—	—	—	—	—
	24th April, 1908.					27th July, 1908.					8th October, 1908.				
0	5·75	35·07	27·66	43	0	13·55	34·90	26·23	181	0	11·85	35·14	26·75	131	0
10	6·04	34·97	27·56	54	485	13·51	34·90	26·24	180	1805	11·85	35·08	26·70	135	1330
20	6·20	34·97	27·53	57	1140	11·11	34·90	26·75	135	3380	11·80	35·16	26·76	129	2650
30	6·20	34·97	27·53	57	1710	8·42	34·90	27·16	92	4515	11·76	35·16	26·77	129	3940
40	—	—	—	—	—	—	—	—	—	—	11·18	35·19	26·90	117	5170
50	6·21	34·97	27·53	58	2860	7·01	34·96	27·40	69	6125	7·82	35·21	27·49	61	6060
70	6·21	35·01	27·56	55	3990	6·91	34·96	27·42	68	7495	7·52	35·21	27·54	57	7240
100	6·23	35·08	27·61	51	5680	—	—	—	—	—	7·11	35·23	27·60	51	8860
110	—	—	—	—	—	6·84	35·12	27·56	55	9955	—	—	—	—	—
140	6·22	35·14	27·66	46	7620	—	—	—	—	—	7·00	35·23	27·62	50	10880
	3rd December, 1908.					—					—				
0	9·25	35·03	27·12	95	0	—	—	—	—	—	—	—	—	—	—
10	9·30	35·08	27·15	92	935	—	—	—	—	—	—	—	—	—	—
20	9·30	35·08	27·15	92	1855	—	—	—	—	—	—	—	—	—	—
30	9·30	35·08	27·15	92	2775	—	—	—	—	—	—	—	—	—	—
50	9·30	35·08	27·15	93	4625	—	—	—	—	—	—	—	—	—	—
70	9·28	35·08	27·15	93	6485	—	—	—	—	—	—	—	—	—	—
100	8·73	35·08	27·26	85	9155	—	—	—	—	—	—	—	—	—	—
130	7·37	35·14	27·50	62	11360	—	—	—	—	—	—	—	—	—	—

Station Sc. 40*b*.

Latitude, 57° 24′ N. ; Longitude, 1° 7′ E.

Depth (Metres).	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/oo.	σt.	v—v′.	e—e′.
	6th February, 1907.					10th April, 1907.					24th July, 1907.				
0	6·25	35·35	27·73	36	0	5·85	35·11	27·69	42	0	11·75	34·99	26·64	140	0
10	6·45	35·21	27·68	42	390	5·90	35·08	27·65	45	435	11·87	34·86	26·59	144	1420
20	6·45	35·21	27·68	42	810	5·90	35·11	27·68	43	875	11·87	34·96	26·59	144	2860
30	6·45	35·18	27·66	45	1245	5·91	35·08	27·65	45	1315	11·69	34·96	26·63	140	4280
40	—	—	—	—	—	5·92	35·07	27·65	47	1775	7·84	35·01	27·33	77	5365
50	6·45	35·20	27·67	44	2135	—	—	—	—	—	—	—	—	—	—
60	—	—	—	—	—	5·93	35·09	27·66	45	2695	7·16	35·01	27·43	68	6815
70	6·46	35·18	27·65	46	3035	—	—	—	—	—	—	—	—	—	—
80	—	—	—	—	—	5·93	35·14	27·70	42	3565	—	—	—	—	—
88	—	—	—	—	—	—	—	—	—	—	7·01	35·01	27·45	67	8705
92	6·47	35·17	27·64	48	4069	—	—	—	—	—	—	—	—	—	—
100	—	—	—	—	—	5·93	35·13	27·69	43	4415	—	—	—	—	—
120	—	—	—	—	—	5·93	35·11	27·68	45	5295	—	—	—	—	—
	10th September, 1907.					6th November, 1907.					14th February, 1908.				
0	11·05	35·23	26·96	109	0	9·45	35·12	27·10	97	0	6·35	35·10	27·61	49	0
10	11·32	35·23	26·91	115	1120	9·92	35·12	27·08	100	985	6·40	34·99	27·51	58	535
20	—	—	—	—	—	9·92	35·12	27·08	100	1985	6·40	35·03	27·54	55	1100
30	11·25	35·17	26·89	117	2280	9·92	35·12	27·08	100	2985	6·41	36·05	27·54	54	1645
40	—	—	—	—	—	9·92	35·16	27·11	97	3970	6·42	35·08	27·57	51	2170
50	11·10	35·14	26·89	119	4640	—	—	—	—	—	6·45	35·08	27·57	52	2685
60	7·70	35·14	27·45	66	5565	9·30	35·19	27·24	86	5800	—	—	—	—	—
70	7·66	35·14	27·46	65	6220	—	—	—	—	—	6·39	35·08	27·58	52	3725
85	7·51	35·14	27·48	64	7188	8·86	35·21	27·32	78	7850	—	—	—	—	—
90	—	—	—	—	—	—	—	—	—	—	6·39	35·08	27·58	52	4765

STATION SC. 40*b*—*continued.*

Latitude, 57° 24′ N. ; Longitude, 1° 7′ E.—*continued.*

Depth (Metres).	Temp. °C.	S.‰.	σt.	v—v′.	e—e′.	Temp. °C.	S.‰.	σt.	v—v′.	e—e′.	Temp. °C.	S.‰.	σt.	v—v′.	e—e.
	28th April, 1908.					27th July, 1908.					8th October, 1908.				
0	6·15	35·05	27·59	50	0	13·75	34·70	26·02	199	0	12·25	34·88	26·47	157	0
10	6·12	34·97	27·54	56	530	13·52	34·65	26·03	198	1985	12·02	34·88	26·52	153	1550
20	6·09	35·01	27·58	53	1075	10·42	34·65	26·63	142	3685	12·00	34·97	26·59	146	3045
30	6·02	35·05	27·61	49	1585	8·78	34·69	26·86	113	4960	11·64	35·01	26·70	138	4465
50	5·99	35·05	27·61	50	2575	7·31	34·78	27·23	87	6960	10·24	35·16	27·07	101	6855
60	—	—	—	—	—	—	—	—	—	—	9·18	35·16	27·23	86	7790
70	5·99	35·05	27·61	53	2575	7·05	34·81	27·29	81	8640	7·22	35·07	27·46	62	8530
85	—	—	—	—	—	6·90	34·90	27·38	72	9787	—	—	—	—	—
88	—	—	—	—	—	—	—	—	—	—	6·82	35·07	27·52	58	9610
90	5·99	35·05	27·61	50	4575	—	—	—	—	—	—	—	—	—	—
	3rd December, 1908.					—					—				
0	9·05	35·03	27·15	92	0	—	—	—	—	—	—	—	—	—	—
10	9·04	35·03	27·15	91	915	—	—	—	—	—	—	—	—	—	—
20	9·01	35·03	27·16	91	1825	—	—	—	—	—	—	—	—	—	—
30	9·00	35·03	27·16	91	2735	—	—	—	—	—	—	—	—	—	—
50	8·94	35·03	27·17	92	4565	—	—	—	—	—	—	—	—	—	—
70	8·90	35·03	27·18	92	6405	—	—	—	—	—	—	—	—	—	—
90	7·64	35·03	27·18	92	8245	—	—	—	—	—	—	—	—	—	—

STATION SC. 41*a*.

Latitude, 56° 48′ N. ; Longitude, 1° 19′ E.

	6th February, 1907.					10th April, 1907.					24th July, 1907.				
0	6·25	35·22	27·71	39	0	5·85	35·08	27·62	44	0	11·75	35·05	26·67	135	0
10	6·42	35·18	27·65	44	415	5·88	35·11	27·61	42	430	11·80	34·97	26·62	142	1385
20	6·42	35·17	27·64	45	860	5·88	35·08	27·61	45	865	11·78	34·99	26·63	139	2790
30	6·42	35·15	27·64	46	1315	5·88	35·08	27·61	45	1315	8·24	35·01	27·27	82	3895
50	6·42	35·17	27·64	46	2235	5·82	35·08	27·62	45	2215	7·00	35·03	27·46	64	5355
70	6·42	35·18	27·66	45	3145	5·82	35·08	27·62	45	3115	6·97	35·03	27·46	63	6625
93	—	—	—	—	—	—	—	—	—	—	6·97	35·03	27·46	64	8086
97	—	—	—	—	—	5·80	35·11	27·63	43	4303	—	—	—	—	—
98	6·44	35·18	27·66	46	4419	—	—	—	—	—	—	—	—	—	—
	10th September, 1907.					6th November, 1907.					14th February, 1908.				
0	11·80	35·14	26·75	129	0	10·25	35·08	26·98	108	0	6·25	35·17	27·69	42	
10	12·00	35·12	26·70	134	1315	10·29	35·07	26·97	109	1085	6·22	35·17	27·69	42	420
20	—	—	—	—	—	10·29	35·08	26·98	108	2170	6·22	35·17	27·69	42	840
30	11·70	35·14	26·78	128	3935	10·29	35·08	26·98	108	3250	6·22	35·14	27·66	43	1265
40	11·50	35·14	26·81	125	5200	10·28	35·08	26·98	109	4335	6·22	35·14	27·66	43	1695
50	7·10	35·19	27·57	54	6095	10·18	35·08	26·99	107	5415	6·22	35·14	27·66	44	2130
60	—	—	—	—	—	7·54	35·08	27·43	68	6290	—	—	—	—	—
70	7·01	35·19	27·59	52	7155	—	—	—	—	—	6·22	35·14	27·66	44	3010
85	—	—	—	—	—	7·23	35·14	27·52	59	7878	—	—	—	—	—
90	6·99	35·19	27·59	53	8205	—	—	—	—	—	6·22	35·17	27·68	44	3890
	28th April, 1908.					27th July, 1908.					8th October, 1908.				
0	5·75	35·10	27·69	42	0	14·55	34·90	26·02	201	0	12·35	34·94	26·50	155	0
10	5·91	35·10	27·67	44	430	14·39	34·92	26·06	196	1985	12·30	34·85	26·43	161	1580
20	5·92	35·10	27·67	44	870	13·18	34·94	26·33	171	3820	12·11	34·87	26·49	155	3160
30	5·82	35·10	27·68	42	1300	10·60	34·94	26·82	124	5295	11·40	34·88	26·63	142	4645
40	—	—	—	—	—	—	—	—	—	—	9·18	34·94	27·06	101	5860
50	5·82	35·10	27·68	43	2150	6·75	34·96	27·44	65	7185	6·82	34·97	27·45	65	6690
70	5·82	35·10	27·68	43	3010	6·52	34·96	27·47	63	8465	6·71	34·97	27·46	64	7980
80	5·82	35·10	27·68	43	3440	—	—	—	—	—	6·66	35·01	27·50	61	8605
88	—	—	—	—	—	6·51	34·96	27·47	63	9599	—	—	—	—	—

STATION Sc. 41*a*—*continued*.

Latitude, 56° 48′ N. ; Longitude, 1° 19′ E.—*continued*.

Depth (Metres).	Temp. °C.	S.°/₀₀.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/₀₀.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/₀₀.	σt.	v—v′.	e—e′.
	3 December, 1908.					—					—				
0	8·25	34·94	27·20	87	0	—	—	—	—	—	—	—	—	—	—
10	8·28	34·94	27·20	87	870	—	—	—	—	—	—	—	—	—	—
20	8·28	34·94	27·20	87	1740	—	—	—	—	—	—	—	—	—	—
30	8·28	34·94	27·20	87	2610	—	—	—	—	—	—	—	—	—	—
50	8·28	34·94	27·20	88	4360	—	—	—	—	—	—	—	—	—	—
70	8·26	34·99	27·25	84	6080	—	—	—	—	—	—	—	—	—	—
90	7·41	34·99	27·37	79	7710	—	—	—	—	—	—	—	—	—	—

STATION Sc. 41*b*.

Latitude, 56° 42′ N. ; Longitude, 0° 35′ E.

	6th February, 1907.					10th April, 1907.					24th July, 1907.				
0	5·15	35·20	27·85	28	0	5·85	35·02	27·62	49	0	12·25	35·05	26·59	144	0
10	6·41	35·18	27·67	44	360	5·93	35·02	27·61	50	495	12·11	34·97	26·57	148	1460
20	6·41	35·18	27·67	44	800	5·93	35·02	27·61	50	995	11·78	35·01	26·65	139	2895
30	6·41	35·17	27·66	45	1245	5·91	35·02	27·61	50	1495	7·79	35·07	27·38	71	3945
40	6·41	35·17	27·66	46	1700	5·91	35·04	27·62	49	1990	—	—	—	—	—
50	—	—	—	—	—	—	—	—	—	—	7·42	35·07	27·43	67	5325
60	6·41	35·17	27·66	46	2620	5·91	35·04	27·62	49	2970	—	—	—	—	—
75	—	—	—	—	—	—	—	—	—	—	7·42	35·07	27·43	67	7000
85	—	—	—	—	—	5·91	35·06	27·63	48	4183	—	—	—	—	—
86	6·41	35·17	27·66	47	3829	—	—	—	—	—	—	—	—	—	—
	10th October, 1907.					6th November, 1907.					14th February, 1908.				
0	11·75	35·12	26·75	130	0	10·15	35·08	27·01	106	0	6·35	34·99	27·52	63	0
10	11·60	35·10	26·77	128	1290	10·11	35·05	26·98	108	1070	6·46	34·99	27·50	58	605
20	—	—	—	—	—	10·11	35·05	26·98	108	2150	6·46	34·99	27·50	58	1185
30	11·26	35·08	26·81	125	3820	10·11	35·05	26·98	108	3230	6·46	34·99	27·50	58	1765
40	10·80	35·07	26·88	118	5035	10·11	35·07	27·00	107	4305	6·46	34·99	27·50	58	2340
60	7·90	35·01	27·33	78	6995	9·42	35·14	27·18	91	6285	6·48	34·99	27·50	59	3515
80	7·88	35·01	27·33	79	8565	9·81	35·16	27·12	97	8165	6·49	34·99	27·50	59	4695
	27th April, 1908.					27th July, 1908.					8th October, 1908.				
0	6·05	35·01	27·58	52	0	14·75	34·83	25·92	210	0	12·35	34·88	26·45	158	0
10	6·21	35·01	27·56	54	530	14·28	34·83	26·01	201	2055	12·24	34·94	26·51	152	1550
20	6·20	35·01	27·56	54	1070	12·88	34·81	26·30	175	3935	12·19	34·94	26·52	152	3070
30	6·11	35·01	27·58	54	1610	8·58	34·74	27·00	112	5370	12·09	34·94	26·55	150	4580
40	—	—	—	—	—	—	—	—	—	—	10·51	34·94	26·84	122	5940
50	6·10	34·97	27·55	61	2760	6·98	34·74	27·24	85	7340	7·80	34·94	27·28	81	6955
70	6·10	34·96	27·53	61	3980	7·00	34·81	27·30	81	9000	7·51	34·94	27·31	76	8525
90	6·10	35·03	27·59	55	5140	—	—	—	—	—	—	—	—	—	—
98	—	—	—	—	—	—	—	—	—	—	7·46	34·94	27·32	77	10667
	3rd December, 1908.					—					—				
0	8·85	34·94	27·11	97	0	—	—	—	—	—	—	—	—	—	—
10	8·91	34·96	27·11	95	960	—	—	—	—	—	—	—	—	—	—
20	8·86	34·96	27·12	95	1910	—	—	—	—	—	—	—	—	—	—
30	8·86	34·99	27·15	93	2850	—	—	—	—	—	—	—	—	—	—
50	8·86	34·99	27·15	94	4720	—	—	—	—	—	—	—	—	—	—
70	8·86	34·99	27·15	94	6600	—	—	—	—	—	—	—	—	—	—
90	8·86	34·99	27·15	95	8490	—	—	—	—	—	—	—	—	—	—

STATION SC. 41c.

Latitude, 56° 35′ N. ; Longitude, 0° 10′ W.

Depth (Metres).	Temp. °C.	S.‰	σt.	v—v′.	e—e′.	Temp. °C.	S.‰.	σt.	v—v′.	e—e′.	Temp. °C.	S.‰.	σt.	v—v′.	e—e′.
	5th February, 1907.					10th April, 1907.					24th July, 1907.				
0	5·95	35·10	27·67	44	0	5·95	34·97	27·58	53	0	12·45	34·99	26·51	152	0
10	6·23	35·07	27·61	50	470	5·80	34·98	27·59	51	520	12·41	34·94	26·48	155	1535
20	6·23	35·07	27·61	50	970	5·80	34·97	27·57	52	1035	12·18	34·96	26·54	149	3055
30	6·28	35·10	27·62	49	1465	5·80	34·97	27·58	52	1555	8·41	34·97	27·22	87	4235
40	6·28	35·03	27·56	55	1985	—	—	—	—	—	—	—	—	—	—
50	—	—	—	—	—	5·80	34·98	27·59	52	2595	7·91	34·99	27·30	79	5895
60	6·28	35·08	27·60	51	3045	—	—	—	—	—	—	—	—	—	—
73	—	—	—	—	—	—	—	—	—	—	7·91	35·01	27·32	78	7701
75	—	—	—	—	—	5·80	35·00	27·60	51	3883	—	—	—	—	—
80	6·23	35·08	27·60	52	4075	—	—	—	—	—	—	—	—	—	—
	10th September, 1907.					6th November, 1907.					14th February, 1908.				
0	11·25	35·01	26·77	129	0	10·15	35·07	27·00	107	0	6·35	34·99	27·52	57	0
10	—	—	—	—	—	10·21	35·01	26·95	112	1095	6·39	34·99	27·51	57	570
20	—	—	—	—	—	10·21	35·01	26·95	112	2215	6·39	34·99	27·51	57	1140
30	—	—	—	—	—	10·21	35·01	26·95	112	3335	6·40	34·99	27·51	57	1710
35	10·71	35·03	26·86	119	4340	—	—	—	—	—	—	—	—	—	—
40	—	—	—	—	—	10·22	35·01	26·95	113	4460	6·40	34·99	27·51	57	2280
50	9·40	35·03	27·09	99	5975	—	—	—	—	—	6·40	34·99	27·51	58	2855
60	—	—	—	—	—	10·22	35·01	26·95	113	6720	—	—	—	—	—
70	9·36	35·07	27·13	96	7925	—	—	—	—	—	6·42	34·99	27·51	59	4025
80	—	—	—	—	—	10·25	35·03	26·95	114	8990	—	—	—	—	—
	27th April, 1908.					27th July, 1908.					7th October, 1908.				
0	6·15	34·81	27·41	63	0	14·45	34·67	25·86	210	0	11·95	34·78	26·45	160	0
10	6·09	34·87	27·46	63	655	14·30	34·67	25·89	202	2060	11·82	34·78	26·48	157	1585
20	5·86	34·87	27·48	61	1270	12·44	34·72	26·80	175	3945	11·80	34·78	26·48	157	3155
30	5·86	34·81	27·45	64	1900	7·90	34·72	27·09	99	5414	11·18	34·85	26·64	140	4640
50	5·89	34·81	27·44	66	3200	7·58	34·72	27·14	95	7354	10·00	34·96	26·94	113	7170
60	5·89	34·81	27·44	66	3860	—	—	—	—	—	—	—	—	—	—
70	—	—	—	—	—	7·58	34·72	27·14	95	9254	—	—	—	—	—
75	—	—	—	—	—	—	—	—	—	—	8·56	34·88	27·12	97	6795
80	5·89	34·85	27·47	64	5160	—	—	—	—	—	—	—	—	—	—
	4th December, 1908.					—					—				
0	9·25	34·94	27·05	102	0	—	—	—	—	—	—	—	—	—	—
10	9·28	34·94	27·05	102	1020	—	—	—	—	—	—	—	—	—	—
20	9·22	34·94	27·06	102	2040	—	—	—	—	—	—	—	—	—	—
30	9·22	34·96	27·07	100	3050	—	—	—	—	—	—	—	—	—	—
50	9·22	34·96	27·07	101	5060	—	—	—	—	—	—	—	—	—	—
75	9·22	34·96	27·07	101	7585	—	—	—	—	—	—	—	—	—	—

STATION SC. 42.

Latitude, 56° 28′ N. ; Longitude, 0° 53′ W.

	5th February, 1907.					5th April, 1907.					24th July, 1907.				
0	5·85	34·94	27·35	55	0	5·35	34·97	27·63	47	0	12·35	34·90	26·47	157	0
10	5·91	34·92	27·52	57	560	5·45	34·97	27·60	48	475	11·62	34·88	26·58	145	1510
20	5·92	34·97	27·57	53	1110	5·45	34·93	27·57	51	970	9·24	34·81	26·96	112	2795
30	5·93	34·92	27·52	57	1660	5·45	34·93	27·57	51	1480	9·12	34·81	26·98	110	3905
40	5·93	34·90	27·51	60	2245	—	—	—	—	—	—	—	—	—	—
50	—	—	—	—	—	5·40	34·97	27·62	48	2470	9·09	34·81	26·98	111	6115
68	5·93	34·94	27·54	57	3883	—	—	—	—	—	—	—	—	—	—
70	—	—	—	—	—	5·40	35·00	27·65	46	3410	—	—	—	—	—

Station Sc. 42—*continued.*

Latitude, 56° 28′ N. ; Longitude, 0° 53′ W.—*continued.*

Depth (Metres).	Temp. °C.	S.‰.	σt.	v—v′.	e—e′.	Temp. °C.	S.‰.	σt.	v—v′.	e—e′.	Temp. °C.	S.‰.	σt.	v—v′.	e—e′.
	10th September, 1907.					6th November, 1907.					14th February, 1908.				
0	11·05	34·92	26·72	132	0	10·35	34·94	26·87	120	0	5·75	34·78	27·43	65	0
10	—	—	—	—	—	10·57	34·94	26·81	123	1215	5·90	34·76	27·39	69	670
20	—	—	—	—	—	10·67	34·94	26·80	125	2455	5·90	34·76	27·39	69	1360
30	9·80	34·90	26·93	114	3690	10·68	34·94	26·80	125	3705	5·91	34·76	27·39	69	2050
40	—	—	—	—	—	—	—	—	—	—	5·91	34·76	27·39	69	2740
50	—	—	—	—	—	10·70	34·88	26·75	131	6265	—	—	—	—	—
60	—	—	—	—	—	—	—	—	—	—	5·93	34·78	27·41	73	4160
65	9·75	34·90	26·94	114	7680	—	—	—	—	—	—	—	—	—	—
70	—	—	—	—	—	10·71	34·88	26·75	131	8885	—	—	—	—	—
	27th April, 1908.					28th July, 1908.					7th October, 1908.				
0	6·35	34·81	27·38	71	0	13·55	34·58	25·97	203	0	12·05	34·72	26·38	166	0
10	6·12	34·81	27·42	68	695	13·41	34·58	26·01	201	2020	11·91	34·72	26·41	164	1650
20	6·00	34·78	27·40	68	1375	9·41	34·58	26·74	131	3680	11·91	34·74	26·43	162	3280
30	5·99	34·85	27·45	63	2030	8·31	34·60	26·97	113	4900	11·16	34·74	26·57	148	4830
50	5·99	34·85	27·45	64	3300	8·24	34·60	26·95	113	7160	10·71	34·85	26·72	133	7640
60	—	—	—	—	—	8·30	34·63	26·97	113	8290	—	—	—	—	—
70	5·99	34·88	27·48	68	4620	—	—	—	—	—	10·71	34·85	26·72	133	10300
	4th December, 1908.					—					—				
0	9·45	34·74	27·92	123	0	—	—	—	—	—	—	—	—	—	—
10	9·70	34·76	27·93	122	1225	—	—	—	—	—	—	—	—	—	—
20	9·70	34·76	27·93	122	2445	—	—	—	—	—	—	—	—	—	—
30	9·70	34·76	27·93	122	3665	—	—	—	—	—	—	—	—	—	—
50	9·70	34·76	27·93	123	6115	—	—	—	—	—	—	—	—	—	—
75	9·69	34·76	27·93	123	9190	—	—	—	—	—	—	—	—	—	—

Station Sc. 43.

Latitude, 56° 24′ N. ; Longitude, 1° 21′ W.

Depth (Metres).	Temp. °C.	S.‰.	σt.	v—v′.	e—e′.	Temp. °C.	S.‰.	σt.	v—v′.	e—e′.	Temp. °C.	S.‰.	σt.	v—v′.	e—e′.
	5th February, 1907.					5th April, 1907.					24th July, 1907.				
0	6·45	34·85	27·52	57	0	5·35	34·87	27·55	54	0	11·65	34·74	26·57	157	0
10	5·44	34·81	27·50	60	585	5·32	34·88	27·56	53	535	11·01	34·65	26·52	152	1545
20	5·44	34·74	27·44	65	1210	5·30	34·87	27·55	53	1065	9·01	34·65	26·86	120	2905
30	5·48	34·78	27·46	63	1850	5·28	34·87	27·55	53	1595	9·00	34·65	26·86	120	4105
40	—	—	—	—	—	5·28	34·84	27·53	56	2140	—	—	—	—	—
46	—	—	—	—	—	—	—	—	—	—	8·95	34·65	26·87	121	6033
55	5·48	34·74	27·43	67	3475	—	—	—	—	—	—	—	—	—	—
62	—	—	—	—	—	5·28	34·85	27·53	56	3372	—	—	—	—	—
	10th September, 1907.					5th November, 1907.					13th February, 1908.				
0	10·85	34·81	26·68	137	0	10·65	34·88	26·75	129	0	6·05	34·81	27·42	167	0
10	—	—	—	—	—	10·65	34·88	26·75	129	1290	6·01	34·76	27·38	169	1680
20	—	—	—	—	—	10·66	34·88	26·75	129	2580	6·01	34·76	27·38	169	3370
25	10·80	34·81	26·69	136	3413	—	—	—	—	—	—	—	—	—	—
30	—	—	—	—	—	10·68	34·88	26·75	130	3875	6·01	34·76	27·38	169	5060
40	—	—	—	—	—	—	—	—	—	—	6·01	34·81	27·43	167	6740
50	10·80	34·81	26·69	138	6838	10·68	34·88	26·75	131	6485	—	—	—	—	—
60	—	—	—	—	—	—	—	—	—	—	6·02	34·81	27·43	167	10080
	27th April, 1908.					28th July, 1908.					7th October, 1908.				
0	6·35	34·70	27·29	80	0	13·05	34·58	26·08	195	0	11·85	34·63	26·35	169	0
10	5·88	34·67	27·32	75	775	12·60	34·58	26·16	187	1910	11·70	34·63	26·38	167	1680
20	5·82	34·67	27·33	75	1525	10·00	34·51	26·59	146	3575	11·69	34·63	26·38	167	3350
30	5·82	34·65	27·31	76	2280	9·33	34·51	26·69	136	4985	11·50	34·63	26·41	163	5000
45	—	—	—	—	—	9·18	34·51	26·72	133	7002	—	—	—	—	—
50	5·82	34·65	27·31	76	3800	—	—	—	—	—	11·34	34·63	26·45	162	8250
60	5·82	34·69	27·34	74	4550	—	—	—	—	—	—	—	—	—	—

Station Sc. 43—*continued.*

Latitude, 56° 24′ N. ; Longitude, 1° 21′ W.—*continued.*

Depth (Metres).	Temp. °C.	S.‰.	σt.	v—v′.	e—e′.	Temp. °C.	S.‰.	σt.	v—v′.	e—e′.	Temp. °C.	S.‰.	σt.	v—v′.	e—e′.
	4th December, 1908.					—					—				
0	9·25	34·72	26·88	119	0	—	—	—	—	—	—	—	—	—	—
10	9·62	34·67	26·78	125	1270	—	—	—	—	—	—	—	—	—	—
20	9·62	34·67	26·78	125	2520	—	—	—	—	—	—	—	—	—	—
30	9·62	34·74	26·84	123	3760	—	—	—	—	—	—	—	—	—	—
50	9·62	34·74	26·84	123	6220	—	—	—	—	—	—	—	—	—	—
65	9·61	34·74	26·84	123	8065	—	—	—	—	—	—	—	—	—	—

Station Sc. 44.

Latitude, 56° 20′ N. ; Longitude, 1° 49′ W.

Depth (Metres).	Temp. °C.	S.‰.	σt.	v—v′.	e—e′.	Temp. °C.	S.‰.	σt.	v—v′.	e—e′.	Temp. °C.	S.‰.	σt.	v—v′.	e—e′.
	5th February, 1907.					5th April, 1907.					25th July, 1907.				
0	5·25	34·68	27·42	67	0	5·45	34·78	27·47	63	0	11·45	34·85	26·60	145	0
10	5·18	34·59	27·35	73	700	5·42	34·81	27·50	60	615	10·64	34·74	26·65	139	1420
20	5·18	34·61	27·37	72	1425	5·31	34·81	27·51	59	1210	9·50	34·74	26·85	121	2720
30	5·18	34·57	27·34	75	2160	5·30	34·78	27·48	61	1810	9·35	34·74	26·88	118	3915
40	—	—	—	—	—	5·30	34·76	27·46	62	2425	9·30	34·74	26·89	118	5095
57	5·18	34·57	27·34	76	4199	—	—	—	—	—	—	—	—	—	—
60	—	—	—	—	—	5·30	34·76	27·46	63	3675	9·20	34·74	26·91	117	7445
	9th October, 1907.					5th November, 1907.					13th February, 1908.				
0	11·35	34·72	26·51	153	0	10·65	34·88	26·76	130	0	5·55	34·40	27·17	92	0
10	—	—	—	—	—	10·60	34·88	26·77	129	1295	5·62	34·43	27·20	91	915
20	10·50	34·70	26·65	140	2930	10·60	34·88	26·77	129	2585	5·62	34·45	27·21	90	1820
30	—	—	—	—	—	10·60	34·88	26·77	129	3875	5·68	34·52	27·24	92	2730
40	10·45	34·70	26·66	140	5730	—	—	—	—	—	—	—	—	—	—
50	—	—	—	—	—	10·62	34·88	26·77	130	6465	—	—	—	—	—
55	—	—	—	—	—	—	—	—	—	—	5·74	34·54	27·25	94	5055
	27th April, 1908.					28th July, 1908.					6th October, 1908.				
0	5·85	34·54	27·23	85	0	13·55	34·23	25·71	230	0	12·15	34·38	26·10	193	0
10	5·70	34·52	27·24	86	855	12·97	34·29	25·87	210	2200	12·11	34·42	26·13	189	1910
20	5·68	34·54	27·25	84	1705	10·65	34·47	26·44	159	4045	11·72	34·54	26·31	172	3715
30	5·68	34·54	27·25	84	2545	10·30	34·47	26·51	154	5610	11·62	34·54	26·33	171	5430
50	5·68	34·54	27·25	84	4225	—	—	—	—	—	—	—	—	—	—
55	—	—	—	—	—	9·49	34·47	26·64	141	9297	11·60	34·58	26·36	168	7667
	4th December, 1908.					—					—				
0	9·35	34·51	26·70	136	0	—	—	—	—	—	—	—	—	—	—
10	9·48	34·49	26·66	140	1380	—	—	—	—	—	—	—	—	—	—
20	9·48	34·49	26·66	140	2780	—	—	—	—	—	—	—	—	—	—
30	9·48	34·51	26·63	138	4170	—	—	—	—	—	—	—	—	—	—
50	9·48	34·51	26·68	138	6930	—	—	—	—	—	—	—	—	—	—
64	9·48	34·51	26·68	138	8862	—	—	—	—	—	—	—	—	—	—

Station Sc. 45.

Latitude, 56° 16′ N. ; Longitude, 2° 17′ W.

Depth (Metres).	Temp. °C.	S.‰.	σt.	v—v′.	e—e′.	Temp. °C.	S.‰.	σt.	v—v′.	e—e′.	Temp. °C.	S.‰.	σt.	v—v′.	e—e′.
	5th February 1907.					4th April, 1907.					25th July, 1907.				
0	5·35	34·74	27·45	64	0	5·45	34·29	27·08	99	0	13·05	34·56	26·05	196	0
10	5·48	34·72	27·41	67	655	5·30	34·56	27·31	77	880	12·70	34·58	26·15	188	1920
20	5·48	34·72	27·41	67	1325	5·25	34·58	27·34	75	1640	10·25	34·58	26·60	144	3580
30	5·46	34·72	27·41	67	1995	5·21	34·65	27·39	69	2360	8·71	34·63	26·90	116	4880
51	5·43	34·74	27·44	66	3392	—	—	—	—	—	—	—	—	—	—
52	—	—	—	—	—	5·21	34·69	27·42	67	3856	8·60	34·63	26·91	116	7432

Station Sc. 45—*continued*.

Latitude, 56° 16′ N. ; Longitude, 2° 17′ W.—*continued*.

Depth (Metres).	Temp. °C.	S.°/₀₀.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/₀₀.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/₀₀.	σt.	v—v′.	e—e′.
	9th September, 1907.					5th November, 1907.					13th February, 1908.				
0	11·80	34·18	26·20	210	0	10·45	34·79	26·72	133	0	5·45	34·09	26·91	110	0
10	—	—	—	—	—	10·62	34·79	26·70	136	1345	5·50	34·18	26·98	107	1085
20	—	—	—	—	—	10·62	34·79	26·70	136	2705	5·78	34·54	27·25	85	2945
25	10·18	34·63	26·66	139	4250	—	—	—	—	—	—	—	—	—	—
30	—	—	—	—	—	10·64	34·76	26·65	138	4075	5·91	34·70	27·44	74	3635
50	9·85	34·63	26·71	136	7688	10·68	34·76	26·66	139	9845	—	—	—	—	—
60	—	—	—	—	—	—	—	—	—	—	5·98	34·70	27·44	70	5795
	25th April, 1908.					28th July, 1908.					6th October, 1908.				
0	5·45	34·31	27·07	100	0	13·25	33·87	25·49	250	0	12·75	33·54	25·25	271	0
10	5·55	34·27	27·05	102	1010	12·51	34·22	25·90	211	7135	12·42	33·64	25·47	252	2615
20	5·59	34·31	27·08	100	2020	10·61	34·42	26·40	162	9000	11·50	34·47	26·29	174	4745
30	5·62	34·36	27·12	96	3000	9·90	34·38	26·55	154	10580	11·50	34·49	26·30	172	6475
50	5·62	34·49	27·22	87	4830	9·88	34–38	26·56	153	13650	11·50	34·51	26·32	171	9905
	4th December, 1908.					—					—				
0	8·75	34·22	26·56	148	0	—	—	—	—	—	—	—	—	—	—
10	8·88	34·23	26·55	148	1480	—	—	—	—	—	—	—	—	—	—
20	9·34	34·49	26·66	137	2905	—	—	—	—	—	—	—	—	—	—
30	9·36	34·49	26·67	137	4275	—	—	—	—	—	—	—	—	—	—
45	9·38	34·49	26·67	138	6337	—	—	—	—	—	—	—	—	—	—

Station Sc. 46.

Latitude, 56° 10′ N. ; Longitude, 2° 45′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/₀₀.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/₀₀.	σt.	v—v′.	e—e′.
	5th February, 1907.					3rd April, 1907.					25th July, 1907.				
0	4·75	34·57	27·39	—	—	5·15	34·23	27·06	100	0	12·85	34·20	25·81	218	0
10	5·01	34·57	27·36	—	—	5·18	34·23	27·06	101	1005	12·12	34·22	25·97	204	2110
20	5·01	34·55	27·35	—	—	5·15	34·33	27·14	93	1975	11·11	34·31	26·25	179	4025
30	5·01	34·57	27·36	—	—	5·12	34·33	27·15	93	2905	10·84	34·31	26·29	175	5795
44	—	—	—	—	—	—	—	—	—	—	10·29	34·38	26·44	161	9827
45	5·01	34·57	27·36	—	—	—	—	—	—	—	—	—	—	—	—
50	—	—	—	—	—	5·12	34·23	27·07	101	4845	—	—	—	—	—
	9th September, 1907.					5th November, 1907.					13th February, 1908.				
0	11·05	34·45	26·36	168	0	10·05	33·62	25·88	212	0	5·65	34·29	27·05	101	0
10	—	—	—	—	—	10·21	33·91	26·09	194	2030	5·70	34·34	27·09	98	995
20	10·83	34·45	26·41	164	3320	10·35	34·05	26·17	186	3930	5·70	34·45	27·17	90	1935
30	—	—	—	—	—	—	—	—	—	—	5·74	34·45	27·17	90	2835
35	10·83	34·45	26·41	164	5780	—	—	—	—	—	—	—	—	—	—
40	—	—	—	—	—	10·50	34·51	26·51	155	7340	5·78	34·49	27·20	88	3725
	25th April, 1908.					28th July, 1908.					6th October, 1908.				
0	5·85	33·66	26·53	151	0	12·15	34·29	26·03	199	0	12·85	33·66	25·39	257	0
10	5·52	33·58	26·52	153	1520	11·24	34·29	26·19	182	1905	12·40	34·09	25·82	278	2375
20	5·42	33·66	26·53	146	3015	10·60	34·33	26·33	169	3660	11·92	34·25	26·04	198	4455
30	5·59	33·75	26·64	141	4450	—	—	—	—	—	11·90	34·33	26·10	191	6400
40	5·60	33·82	26·70	136	5835	—	—	—	—	—	11·60	34·38	26·21	182	8265
	4th December, 1908.					—					—				
0	8·65	33·91	26·35	170	0	—	—	—	—	—	—	—	—	—	—
10	8·92	34·33	26·62	142	1560	—	—	—	—	—	—	—	—	—	—
20	9·00	34·42	26·66	136	2950	—	—	—	—	—	—	—	—	—	—
35	9·05	34·52	26·74	130	4945	—	—	—	—	—	—	—	—	—	—

STATION Sc. 52*d*.

Latitude, 60° 17′ N.; Longitude, 6° 11′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀.	σt	v—v′.	e—e′	Temp. °C.	S.°/₀₀.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/₀₀.	σt.	v—v′.	e—e′.
	24th August, 1908.					—					—				
0	11·25	35·30	26·98	108	0	—	—	—	—	—	—	—	—	—	—
100	9·23	35·28	27·33	78	9300	—	—	—	—	—	—	—	—	—	—
400	5·18	35·08	27·74	43	12835	—	—	—	—	—	—	—	—	—	—
700	1·54	34·90	27·95	22	13810	—	—	—	—	—	—	—	—	—	—
1000	1·15	34·90	27·98	18	14410	—	—	—	—	—	—	—	—	—	—

STATION Sc. 53.

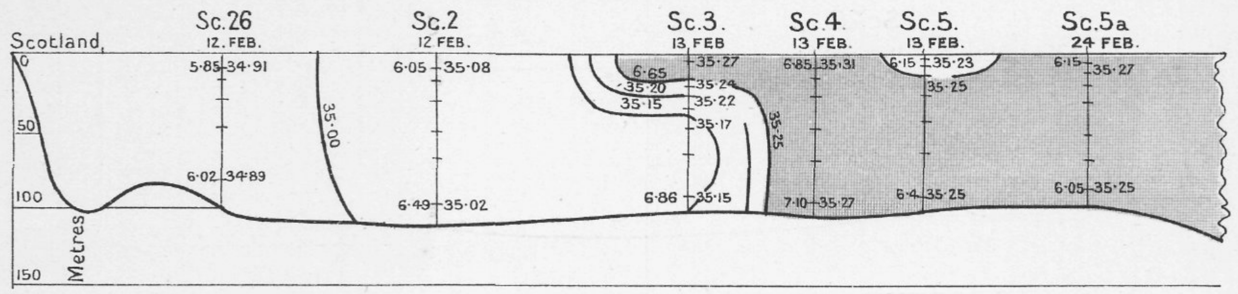
Latitude, 59° 36′ N.; Longitude, 7° 0′ W.

Depth (Metres).	Temp. °C.	S.°/₀₀.	σt	v—v′.	e—e′	Temp. °C.	S.°/₀₀.	σt.	v—v′.	e—e′.	Temp. °C.	S.°/₀₀.	σt.	v—v′.	e—e′.
	17th August, 1907.					—					—				
0	11·40	35·32	26·96	110	0	—	—	—	—	—	—	—	—	—	—
10	11·31	35·23	26·91	114	1120	—	—	—	—	—	—	—	—	—	—
20	11·00	35·31	27·04	102	2200	—	—	—	—	—	—	—	—	—	—
30	10·62	35·25	27·06	101	3215	—	—	—	—	—	—	—	—	—	—
40	10·35	35·25	27·11	97	4205	—	—	—	—	—	—	—	—	—	—
60	9·55	35·26	27·26	83	6005	—	—	—	—	—	—	—	—	—	—
80	9·24	35·30	27·34	77	7605	—	—	—	—	—	—	—	—	—	—
100	9·10	35·26	27·33	78	9155	—	—	—	—	—	—	—	—	—	—
150	8·89	35·30	27·39	72	12905	—	—	—	—	—	—	—	—	—	—
200	8·80	35·30	27·40	73	16530	—	—	—	—	—	—	—	—	—	—
400	8·42	35·26	27·44	74	31230	—	—	—	—	—	—	—	—	—	—
600	8·24	35·21	27·42	79	46530	—	—	—	—	—	—	—	—	—	—
800	7·90	35·16	27·42	81	62530	—	—	—	—	—	—	—	—	—	—
1000	7·22	35·16	27·53	75	78130	—	—	—	—	—	—	—	—	—	—

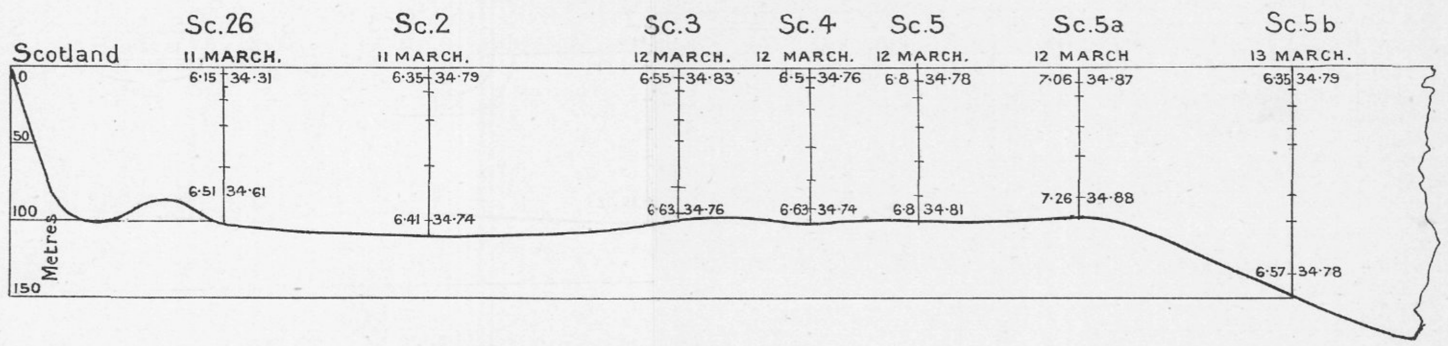
North Sea between Scotland and Shetland.

1907 – 1908.

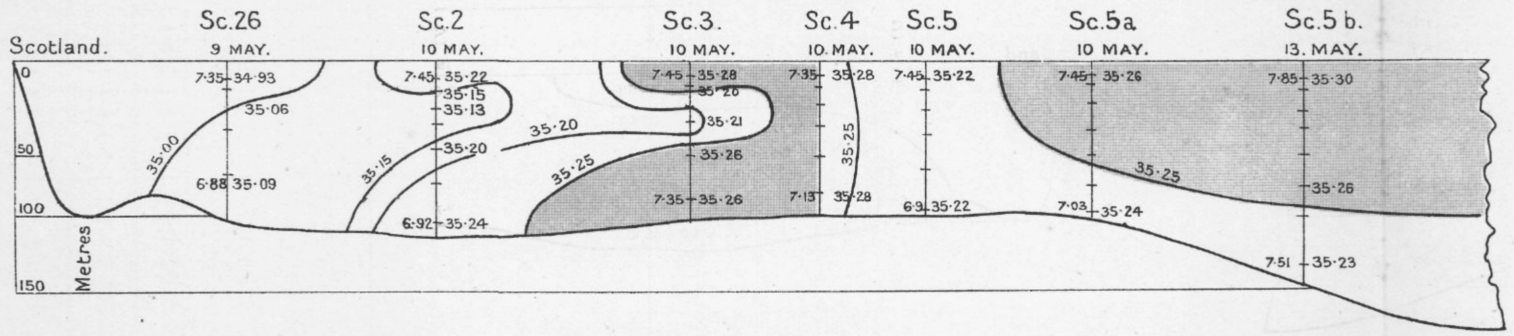
FEBRUARY, 1907.



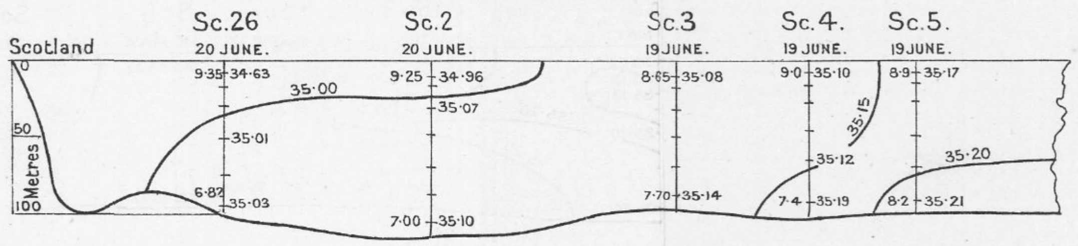
MARCH, 1908.



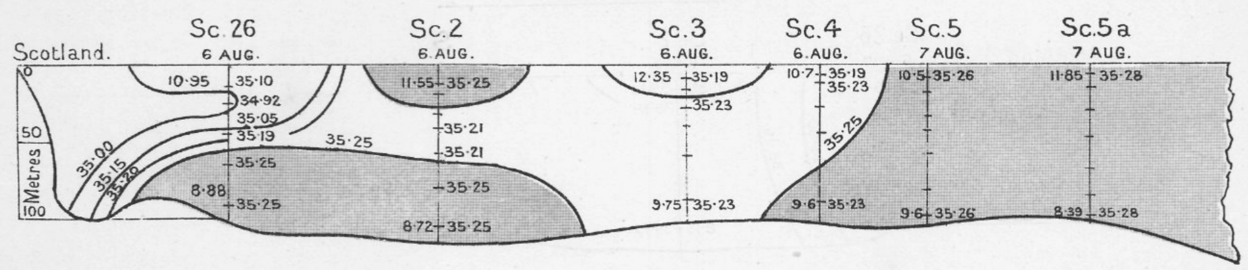
MAY, 1907.



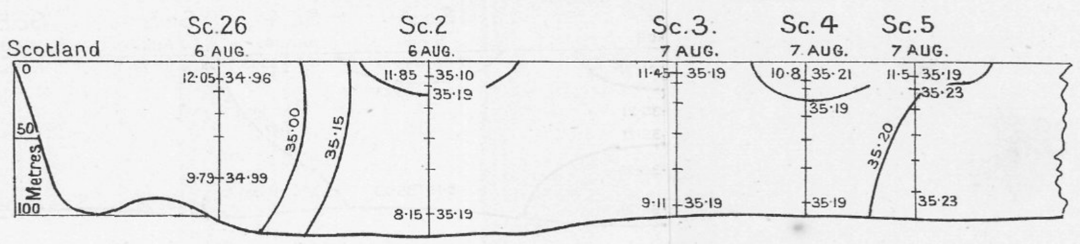
JUNE, 1908.



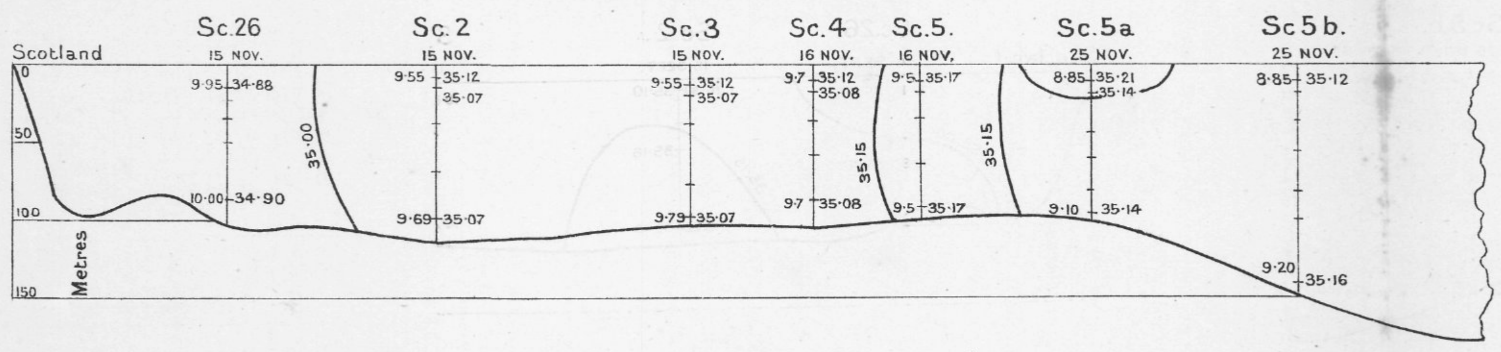
AUGUST, 1907.



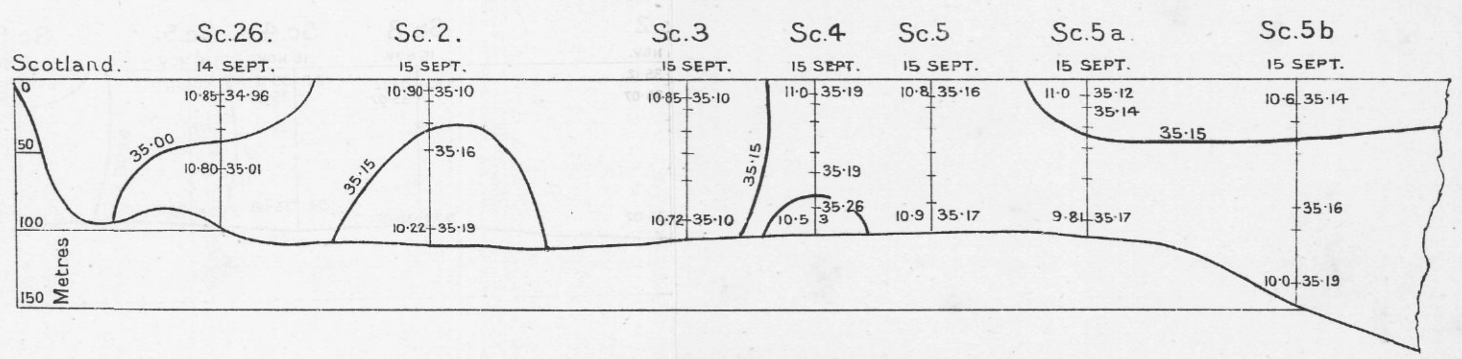
AUGUST, 1908.



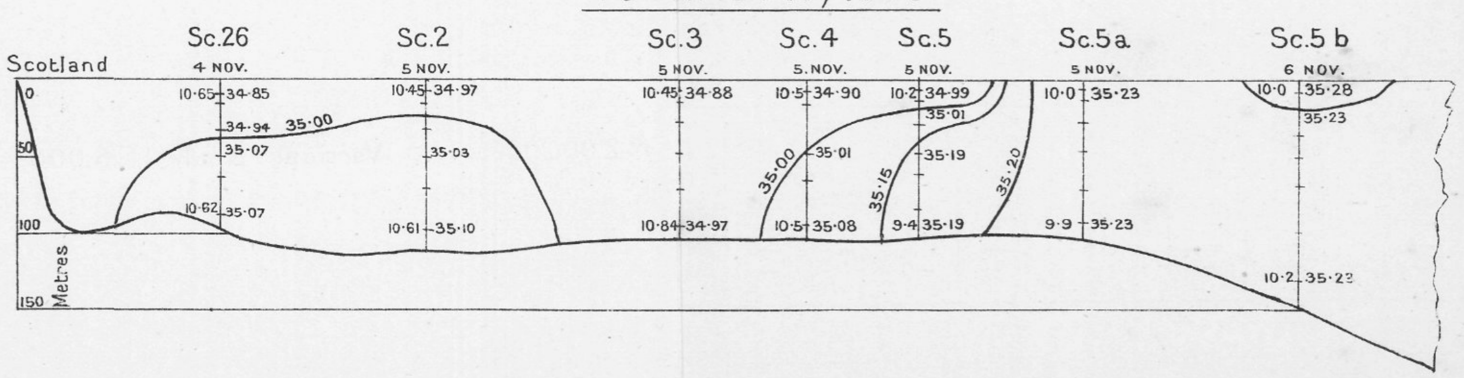
NOVEMBER, 1907.



SEPTEMBER, 1908.



NOVEMBER, 1908.



Horizontal Scale 1: 2.000.000. Vertical Scale 1: 5.000.

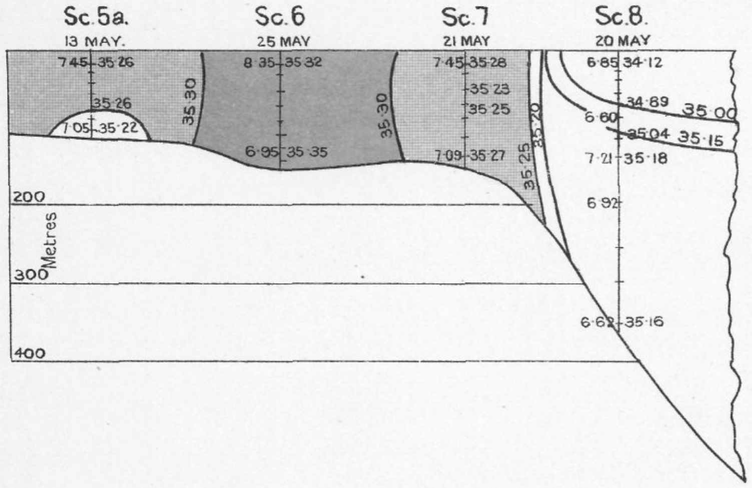
2201. Wt 13507. 58. 1000. 5/09.

Weller & Graham, Ltd Litho London.

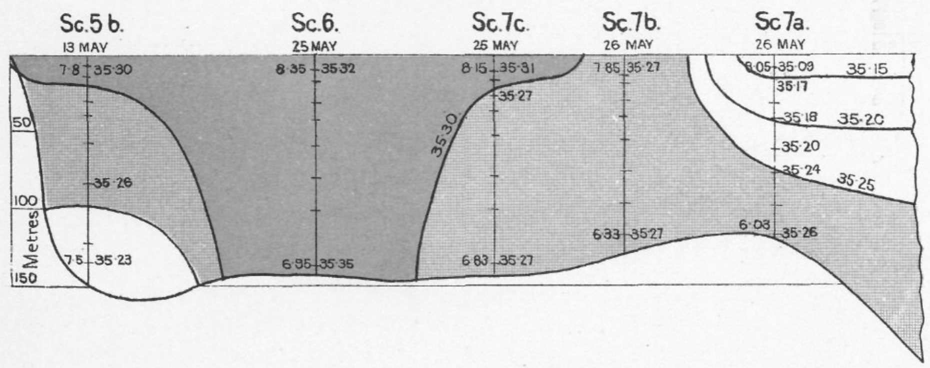
Section from North of Shetland Eastwards

1907 1908.

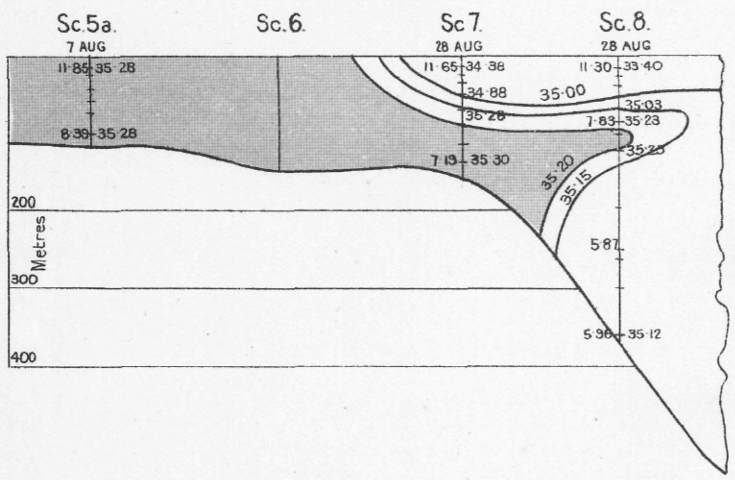
MAY 1907.



MAY 1907.



AUGUST 1907.



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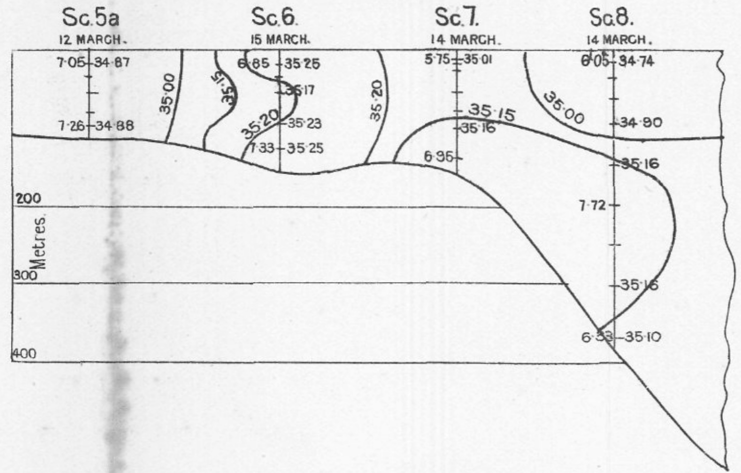
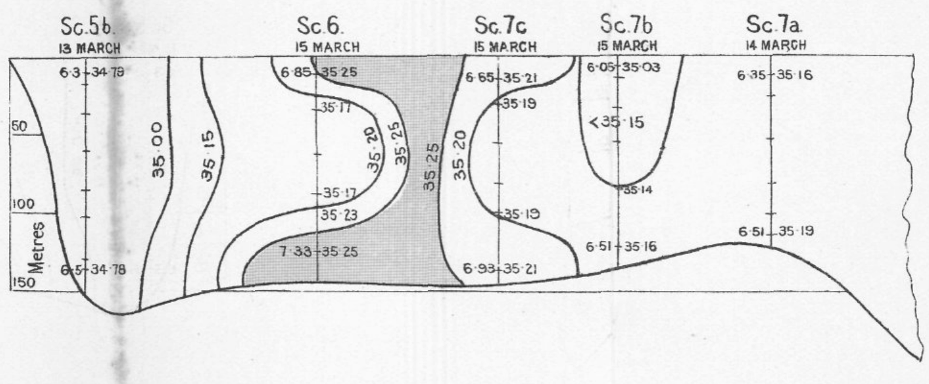
Vertical Scale 1: 5,000

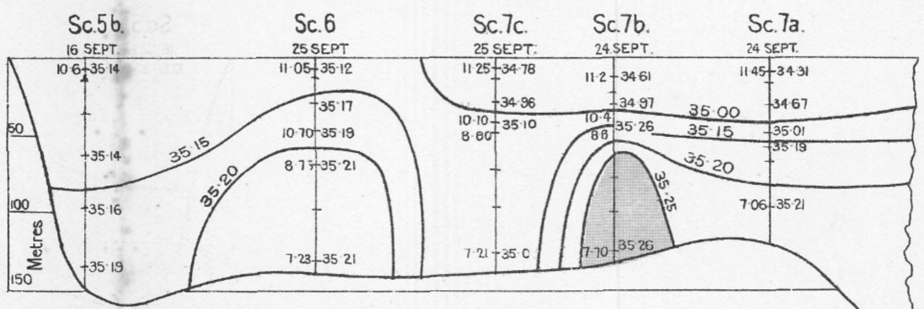
MARCH 1908.



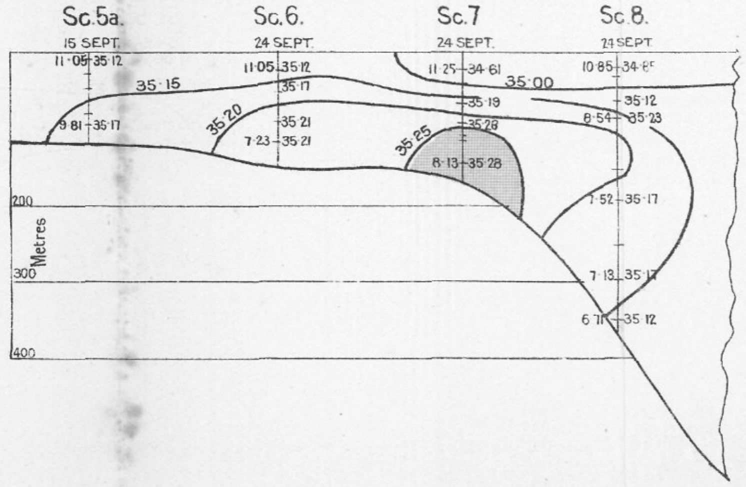
MARCH 1908.



SEPTEMBER 1908.



SEPTEMBER 1908

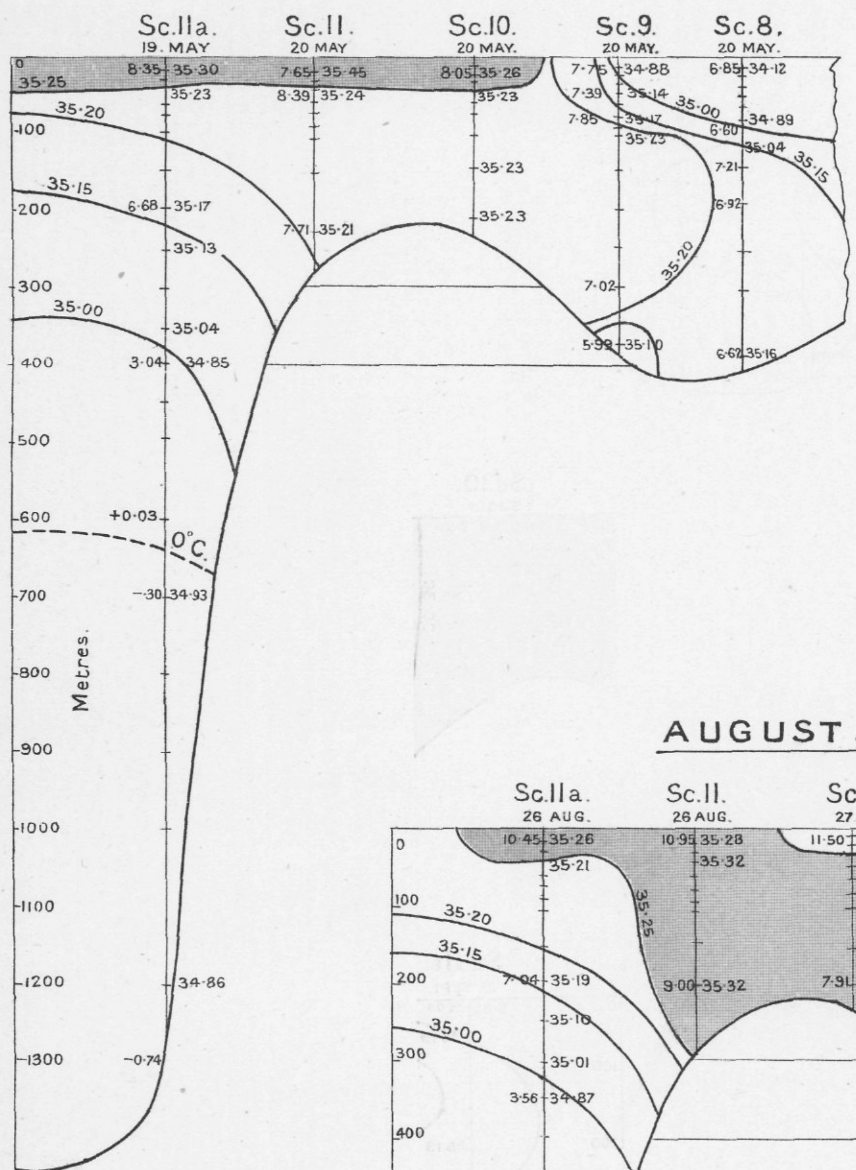


Weller & Graham Ltd Litho, London

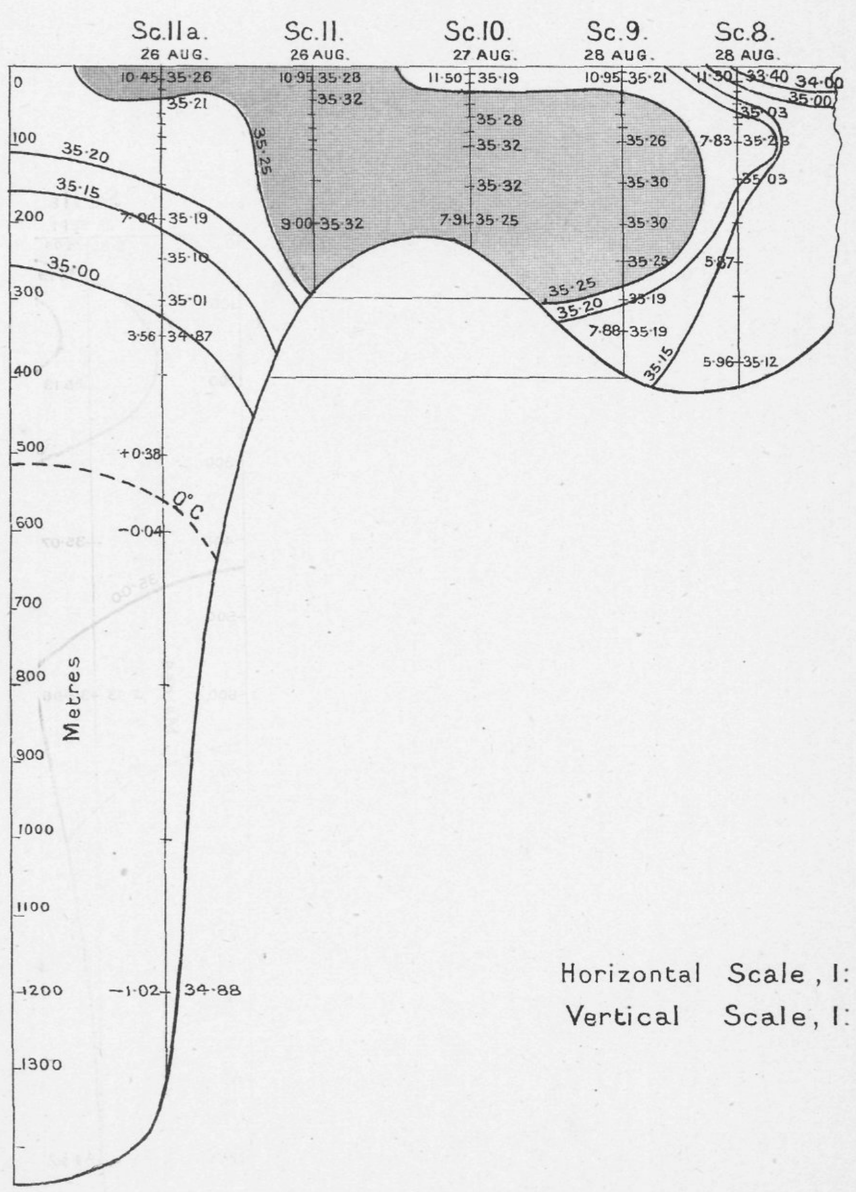
Entrance from North Sea to Norwegian Sea.

1907 - 1908.

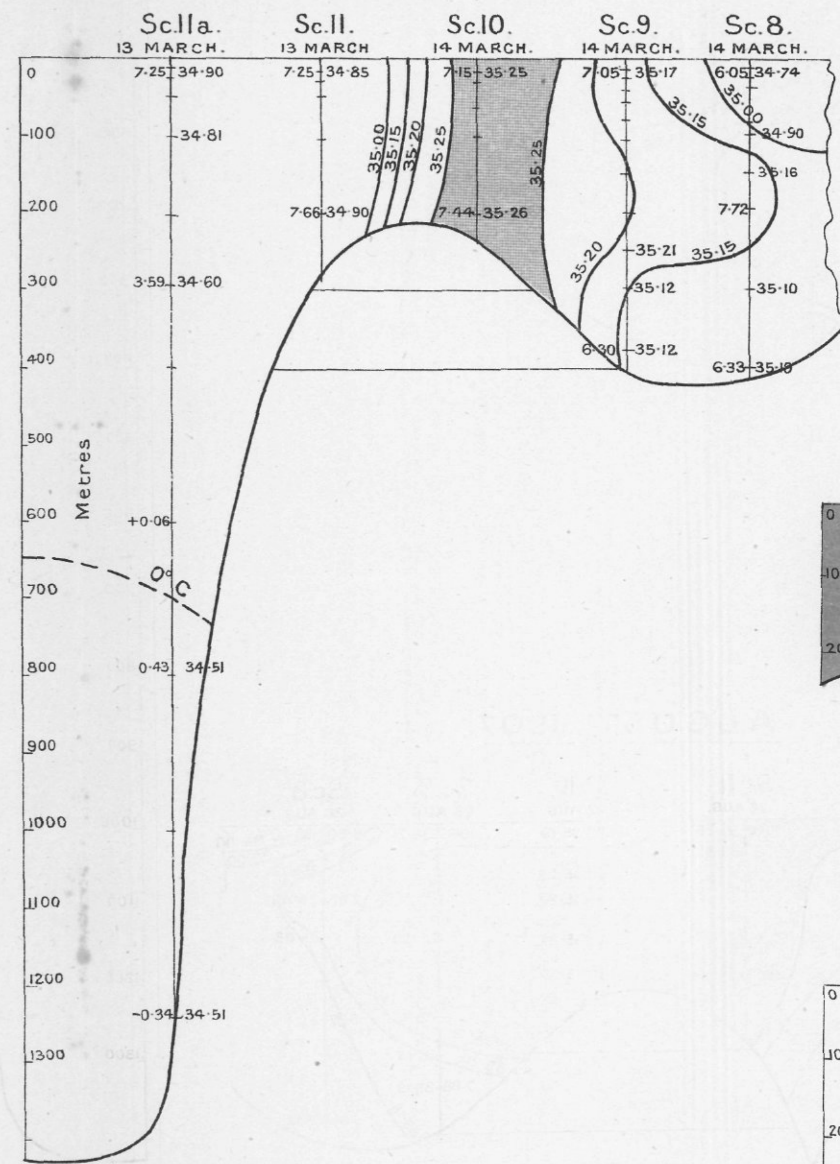
May, 1907.



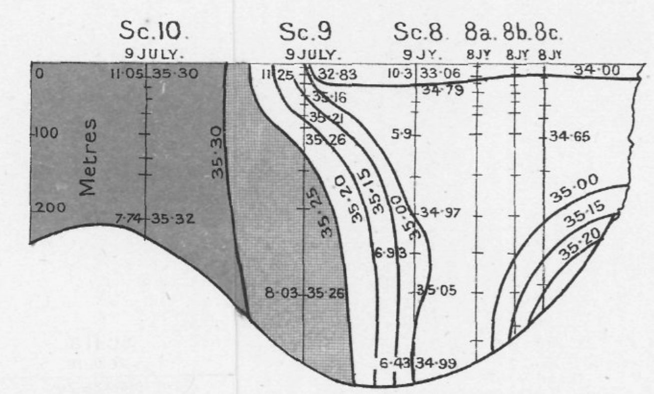
August, 1907.



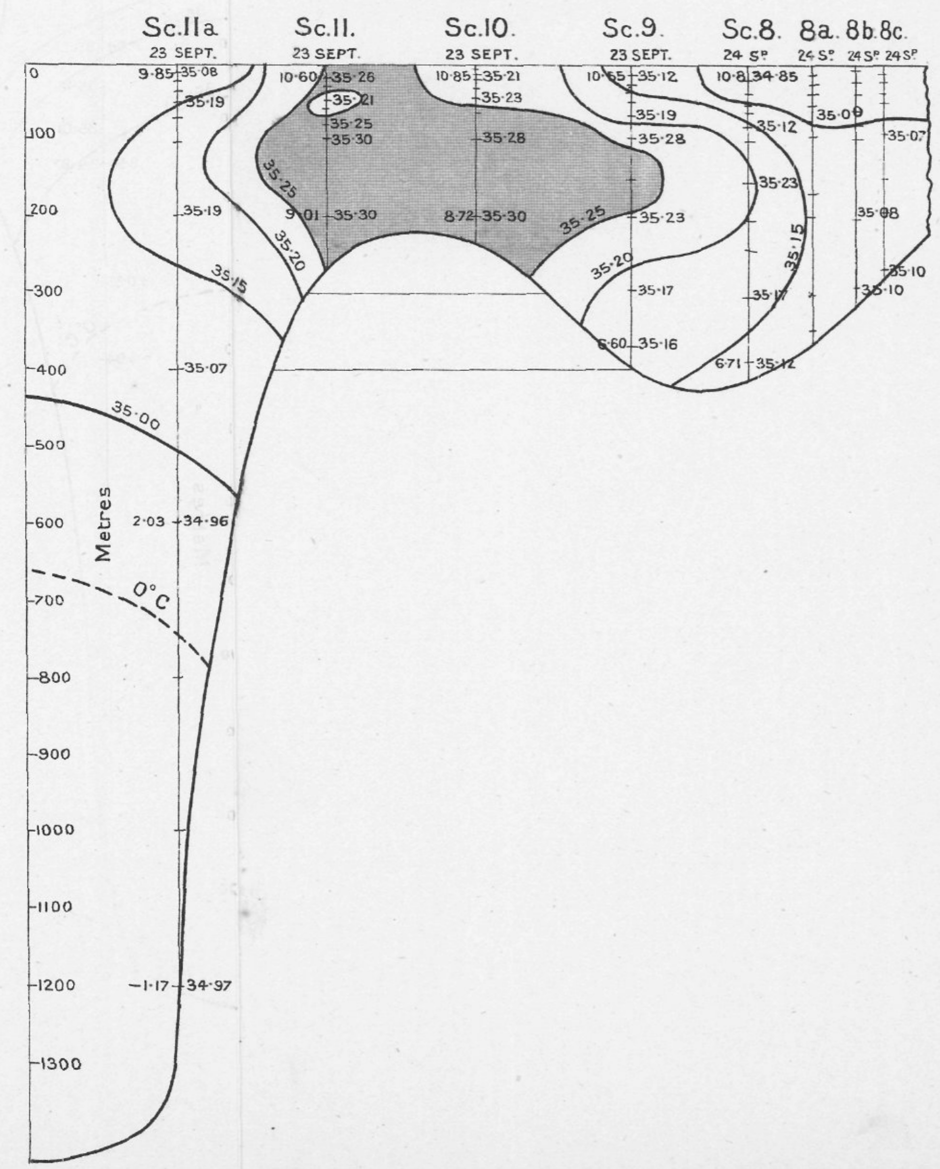
March, 1908.



July, 1908.



September, 1908.



Horizontal Scale, 1: 2.000.000.
Vertical Scale, 1: 10.000.

2204.

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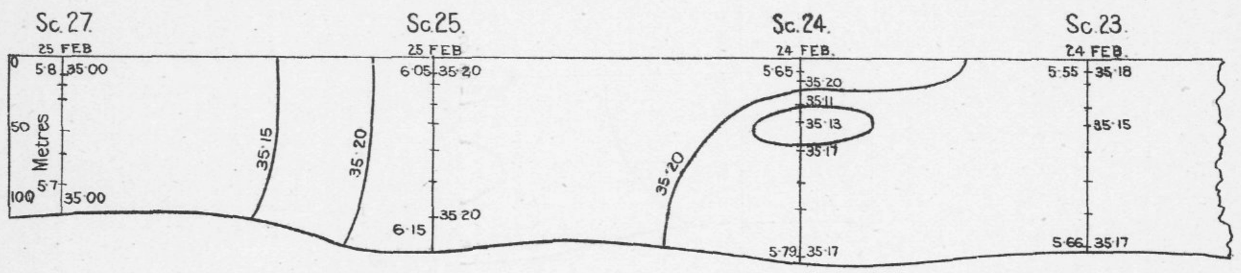
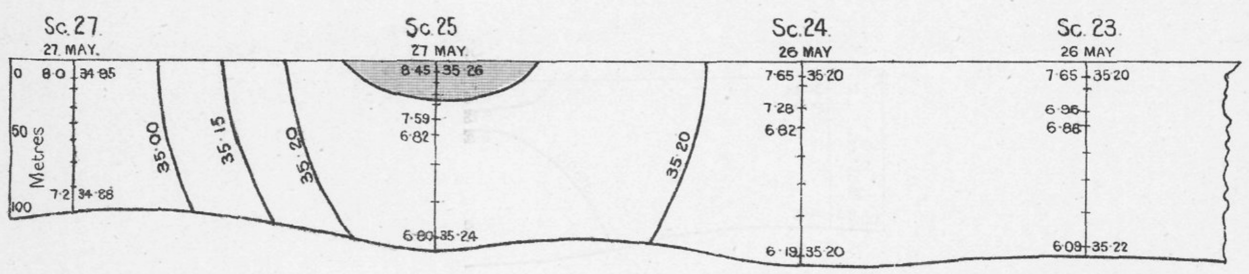
North Sea North Western Area.

1907–1908.

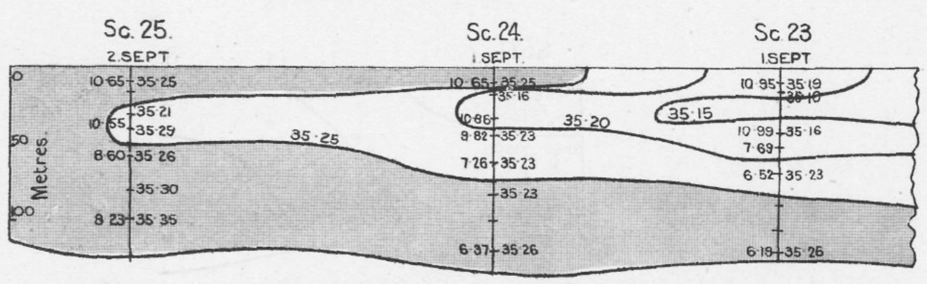
FEBRUARY 1907



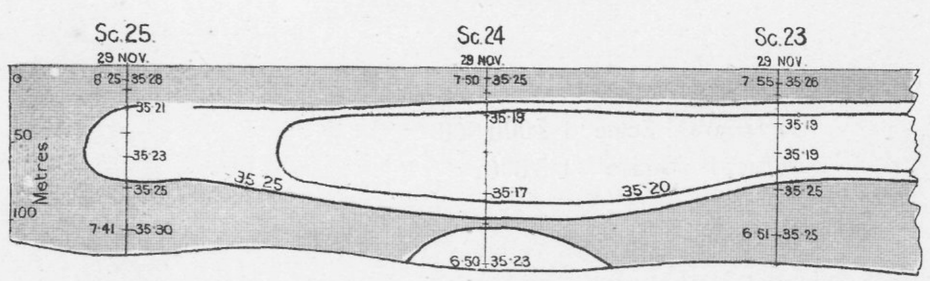
MAY 1907



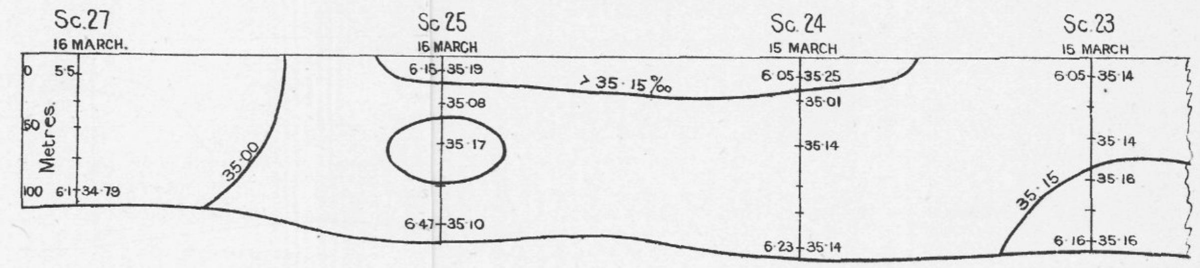
SEPTEMBER 1907



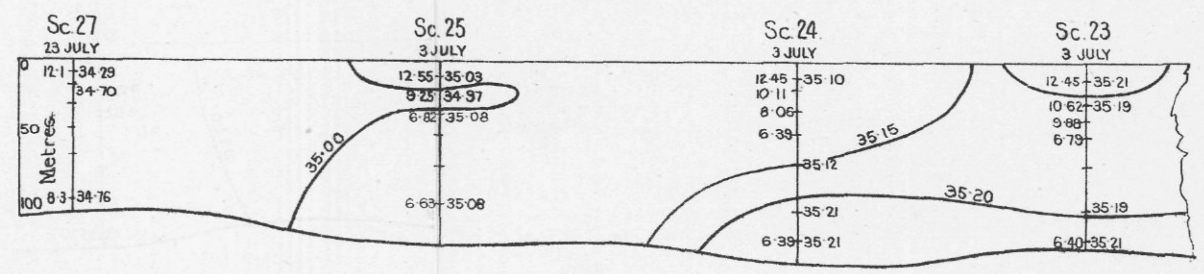
NOVEMBER 1907.



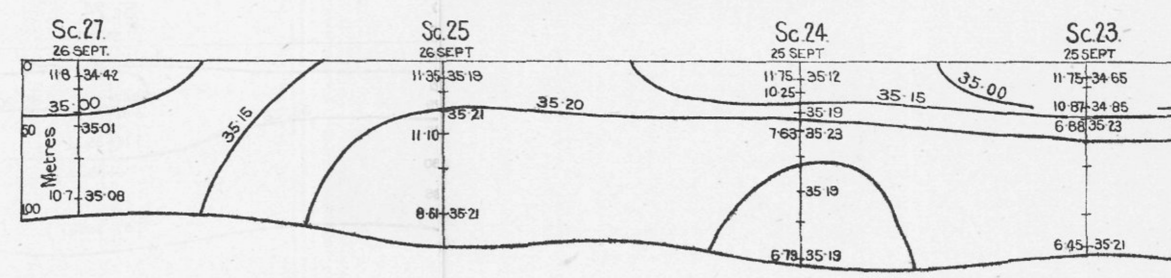
MARCH 1908.



JULY 1908.



SEPTEMBER 1908



Horizontal Scale 1:2,000,000.
Vertical Scale 1:5,000.

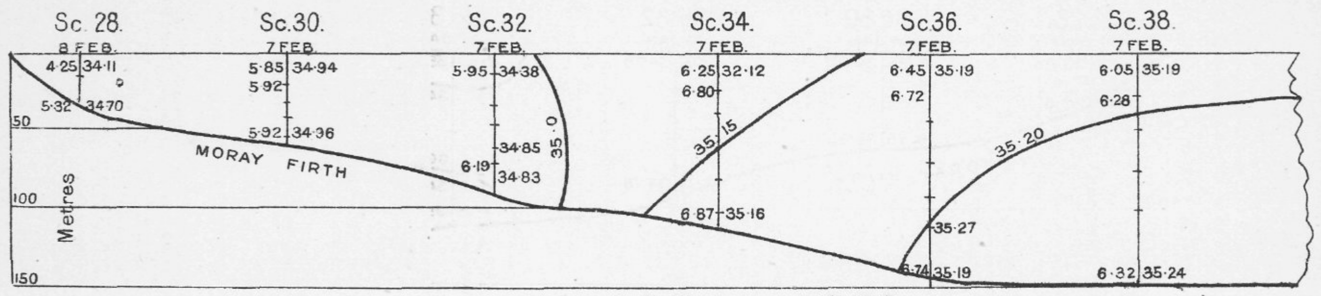
Weller & Graham, Ltd. Lithos, London

Sections from Moray Firth towards Norway.

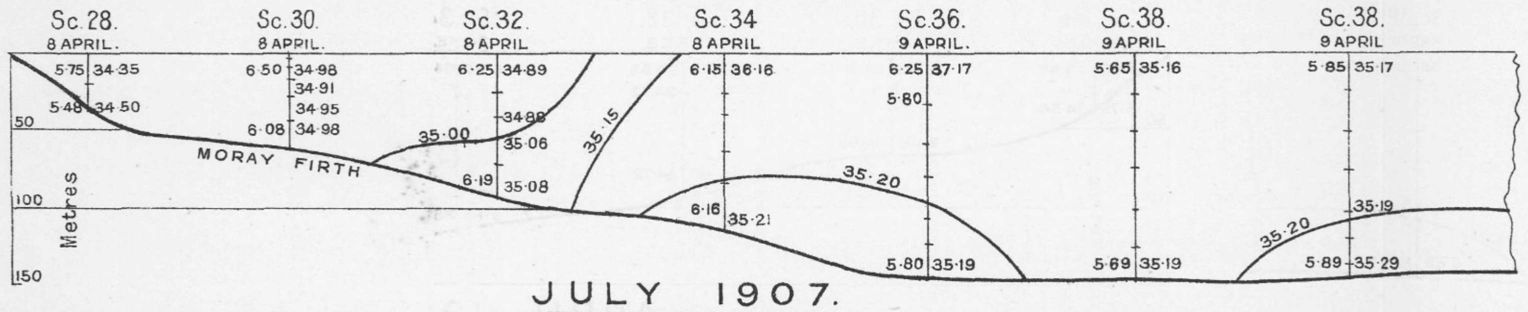
1907 — 1908.

Plate V.

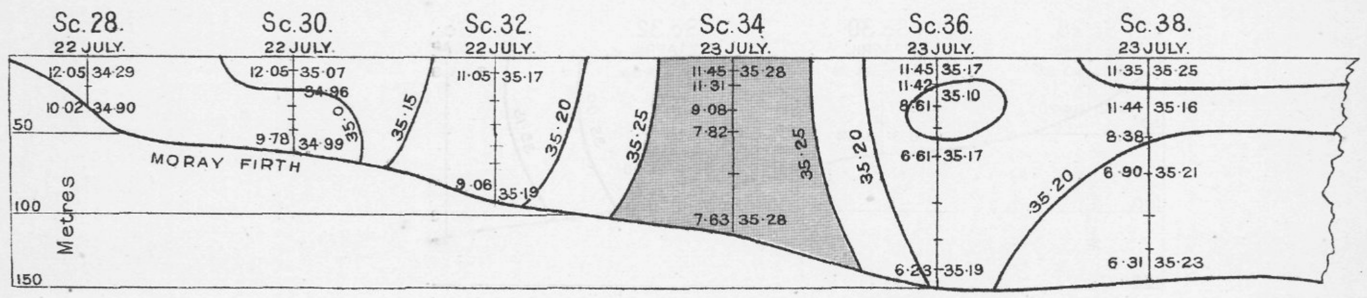
February 1907.



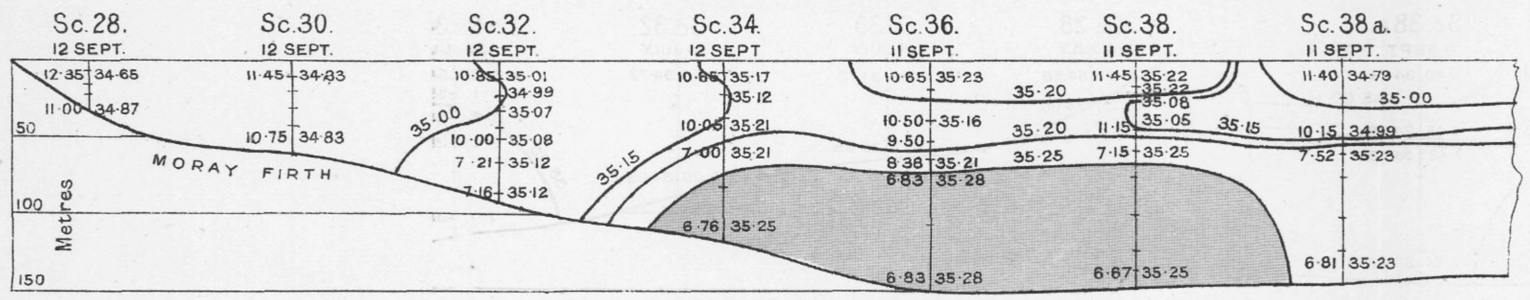
April 1907.



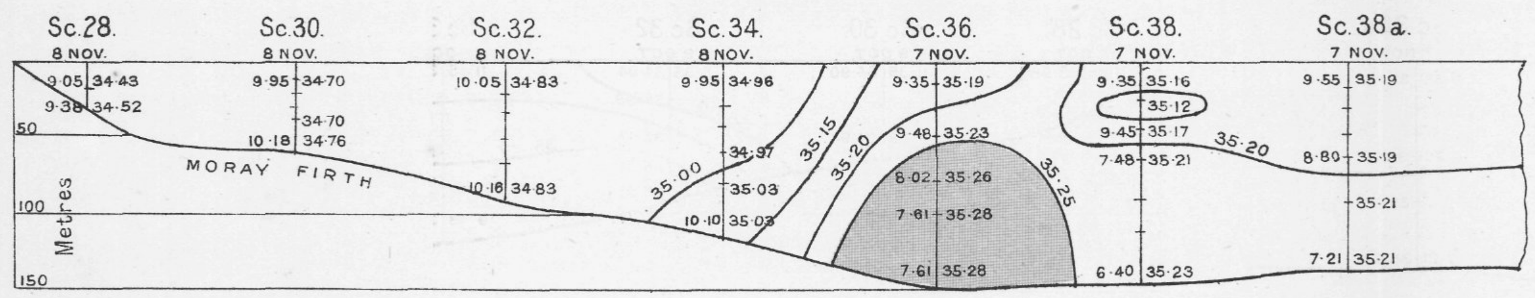
July 1907.



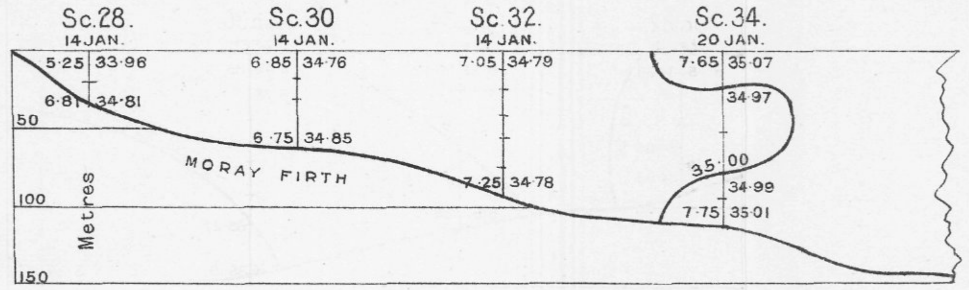
September 1907.



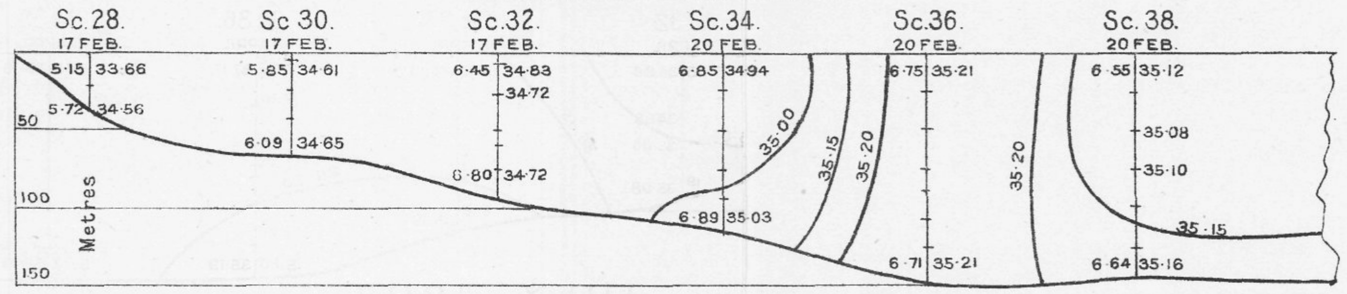
November 1907.



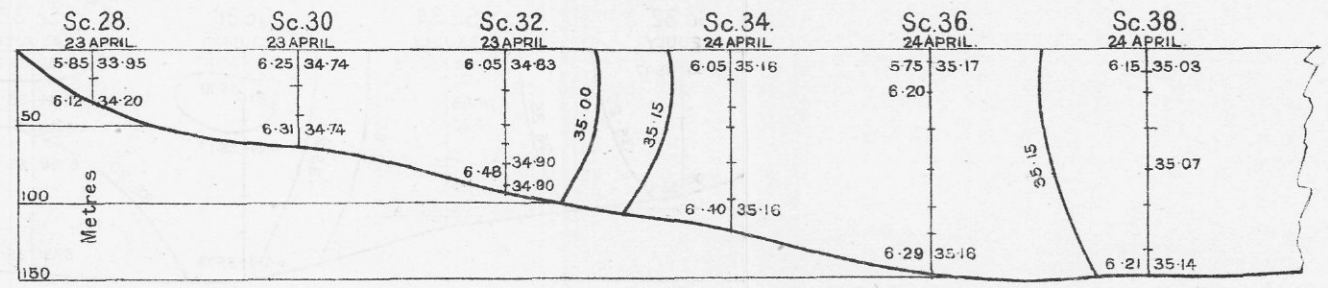
January 1908.



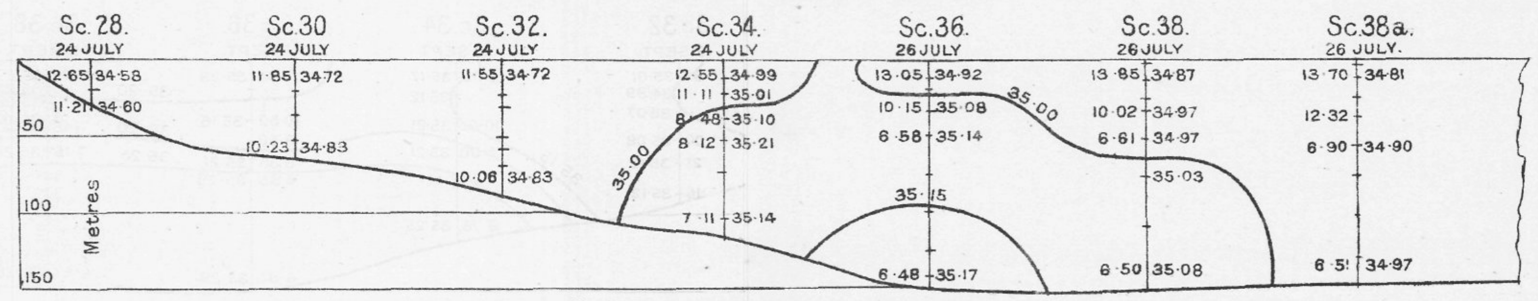
February 1908.



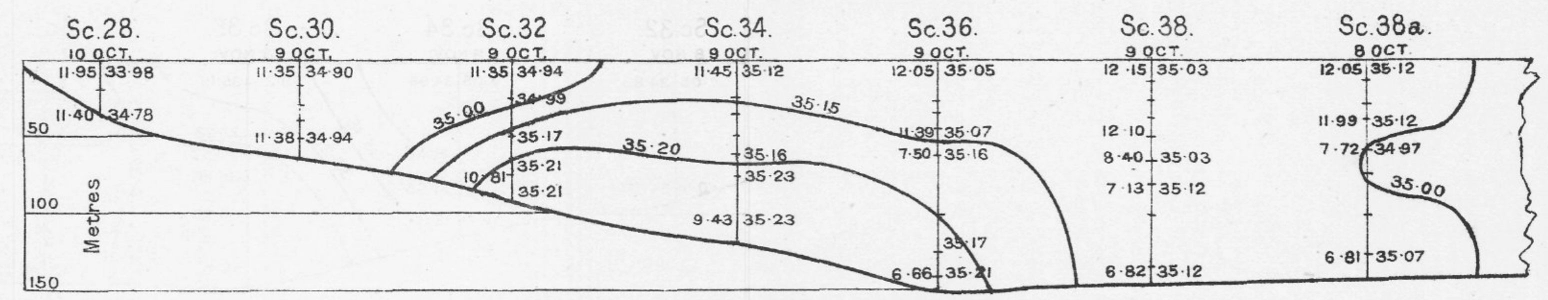
April 1908.



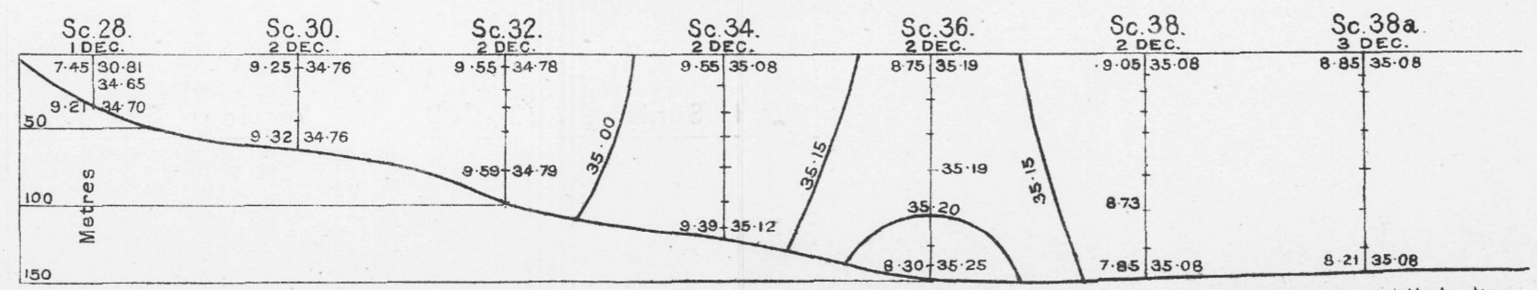
July 1908.



October 1908.



December 1908.



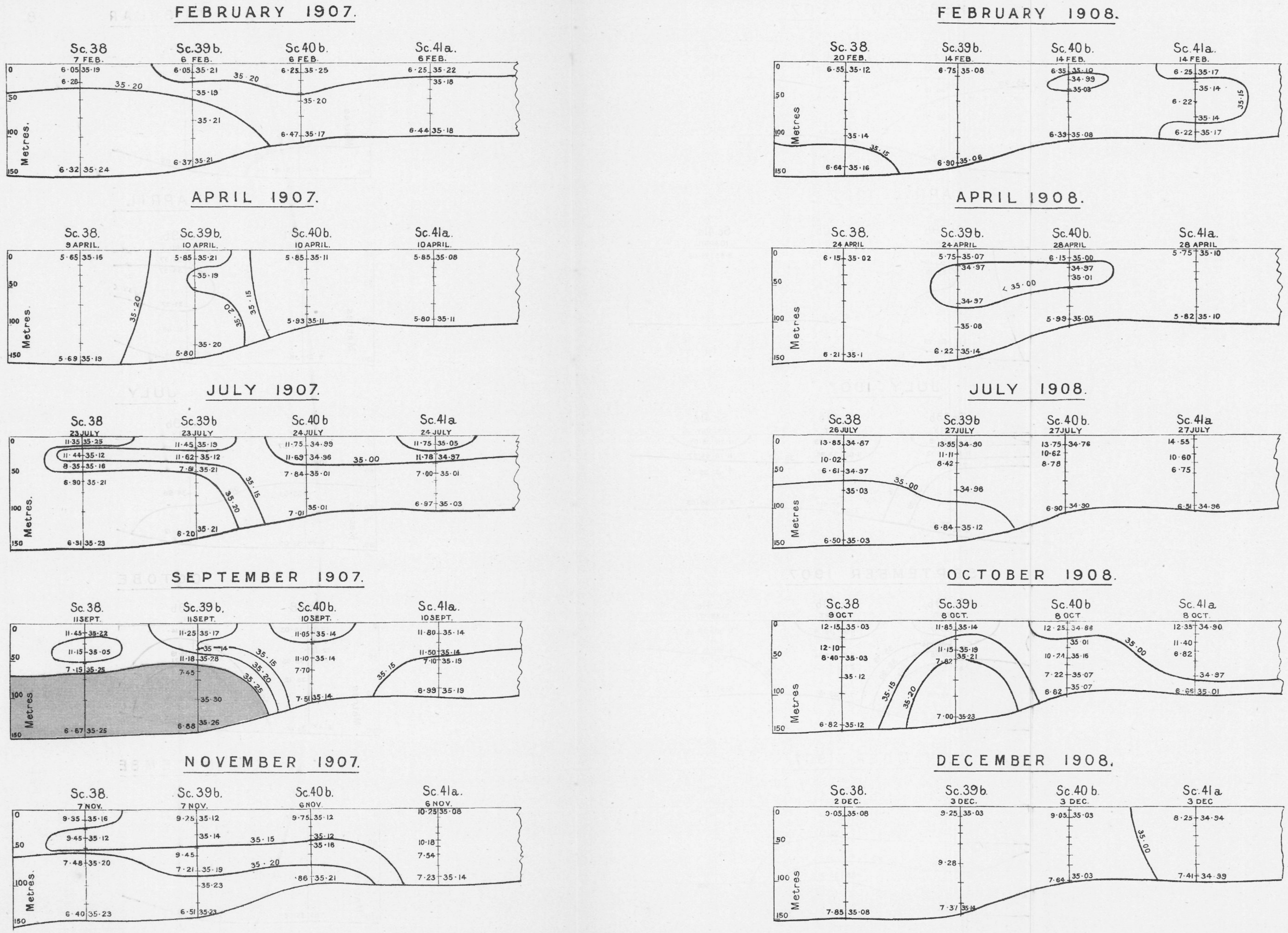
Horizontal Scale 1:2,000,000. Vertical Scale 1:5,000.

2204.

Weller & Graham, Ltd. Litho. London

Section in North Sea, from North to South, about 1° E.

1907–1908.



Horizontal Scale 1: 2,000,000.

Vertical Scale 1: 5000.

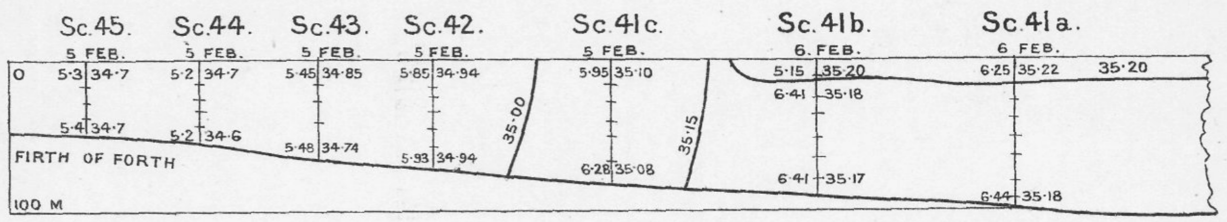
2204

Weller & Graham. Ltd. Litho. London.

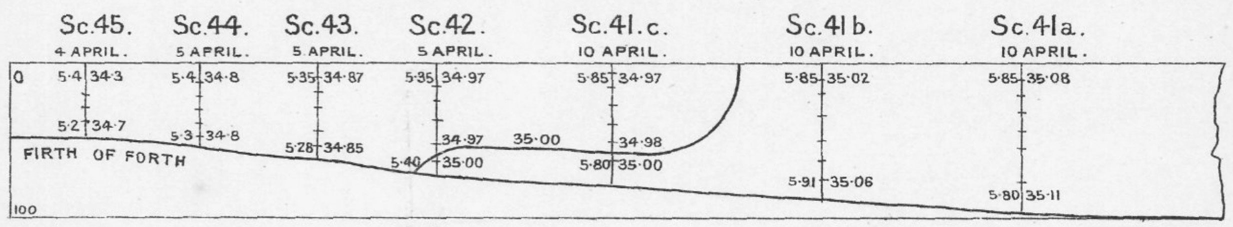
Sections from Firth of Forth towards Norwegian Coast.

1907 – 1908.

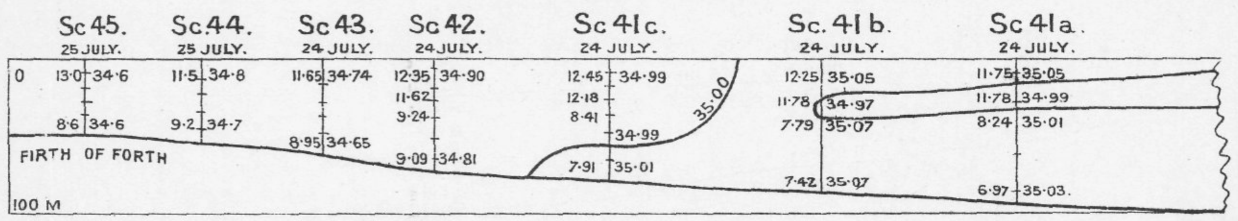
FEBRUARY, 1907.



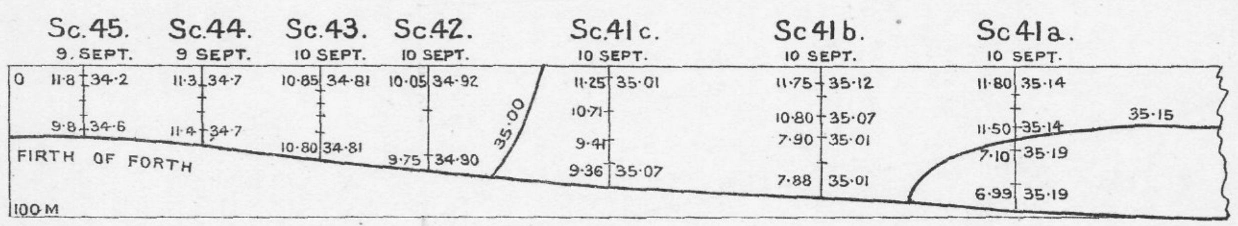
APRIL, 1907.



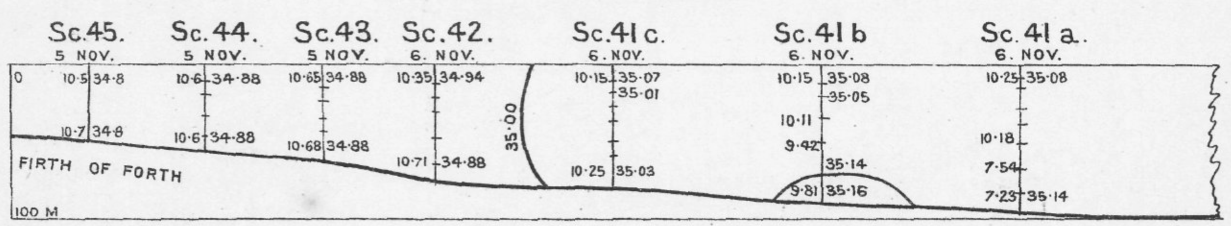
JULY, 1907.



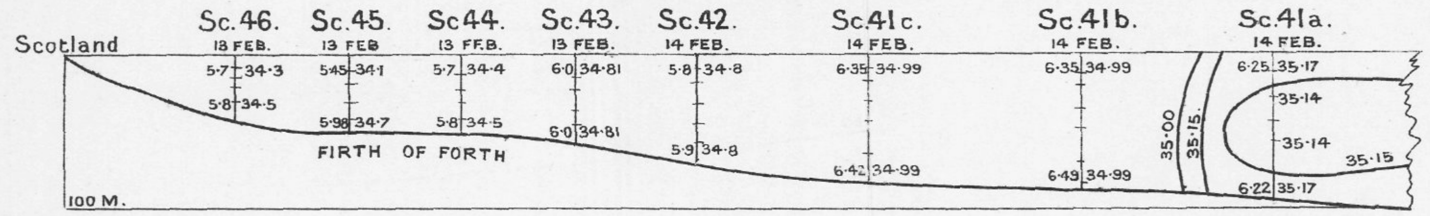
SEPTEMBER, 1907.



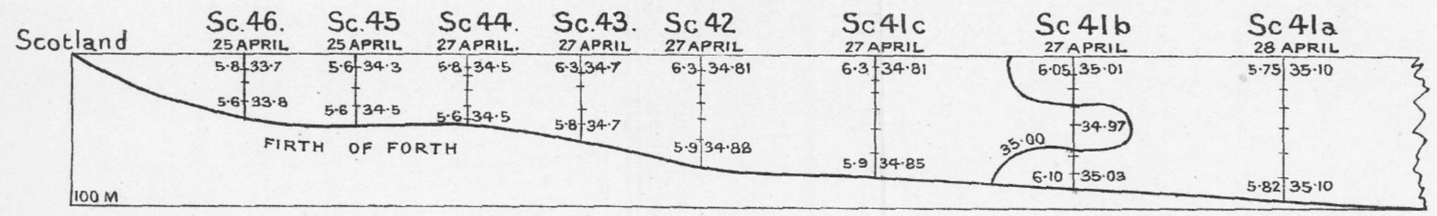
NOVEMBER, 1907.



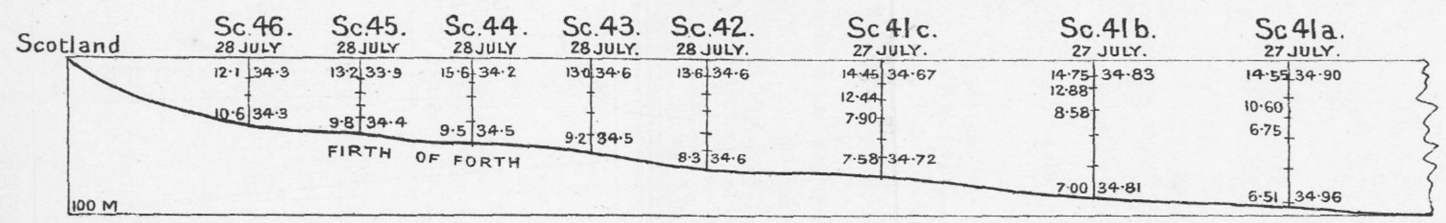
FEBRUARY, 1908.



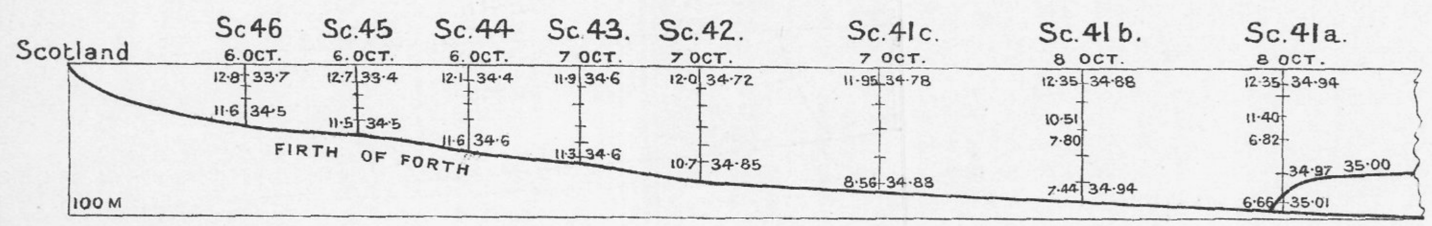
APRIL, 1908



JULY, 1908.



OCTOBER, 1908.



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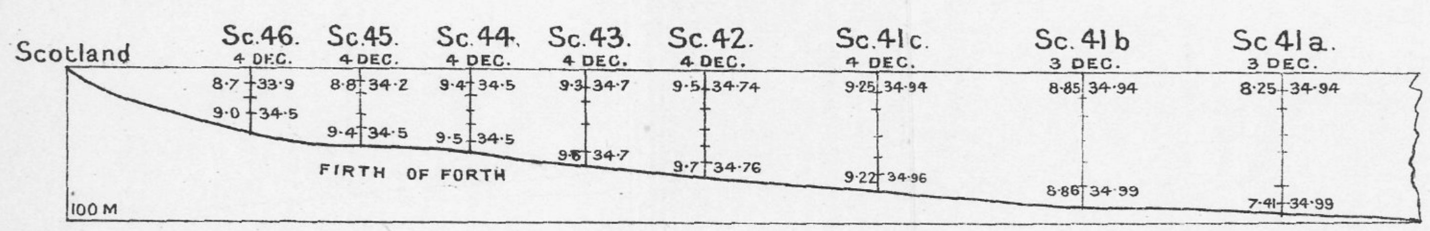

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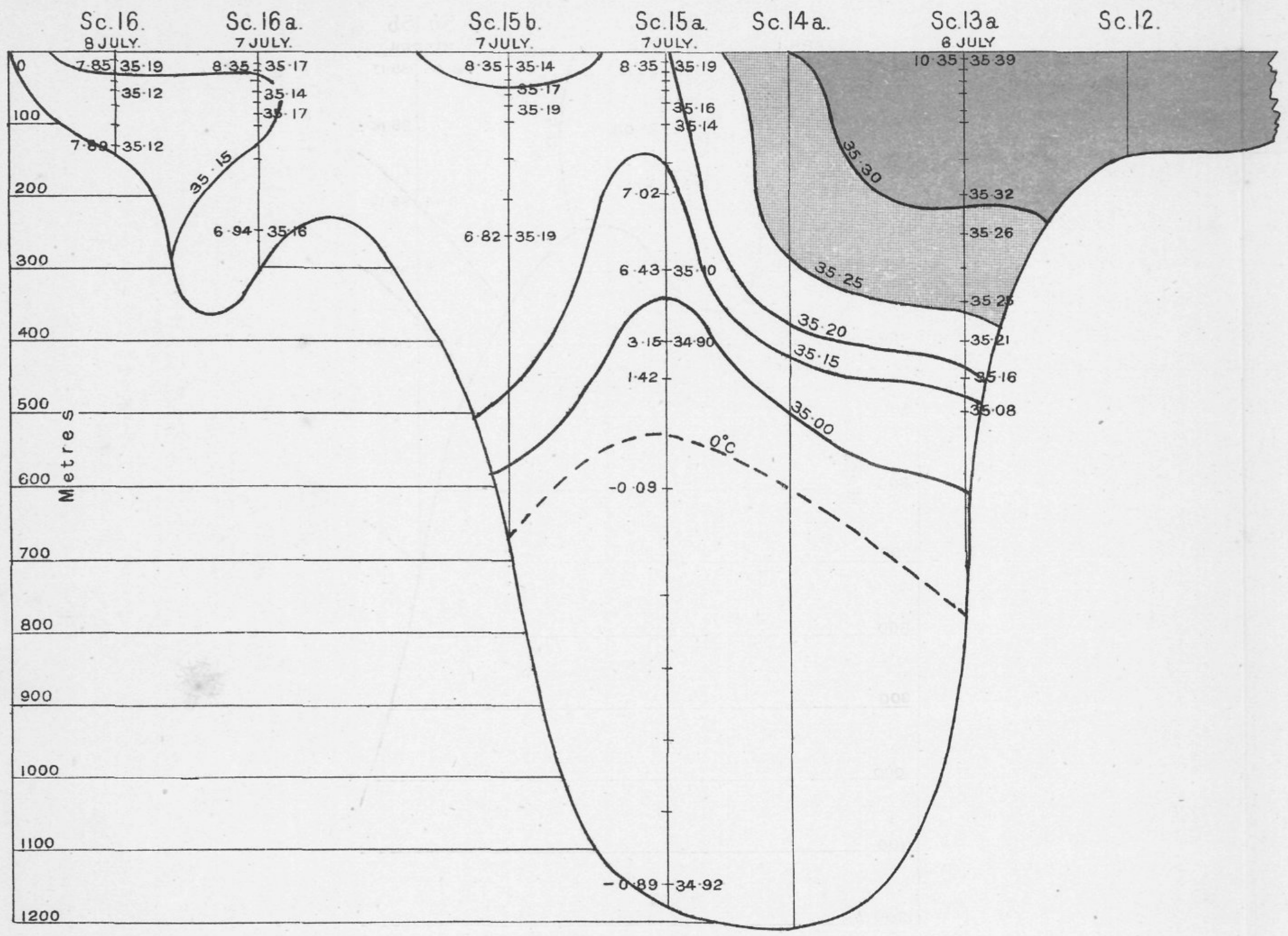

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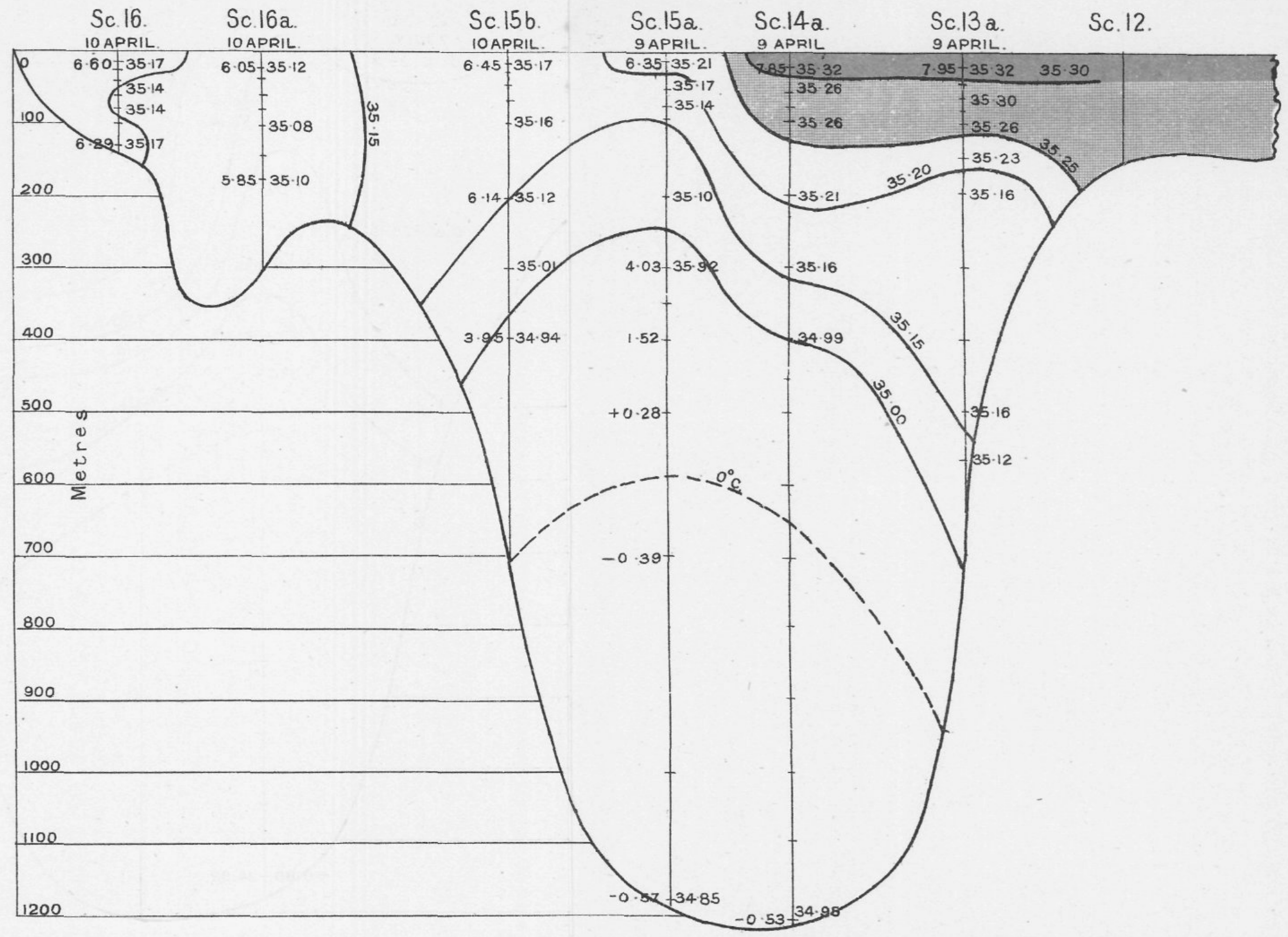

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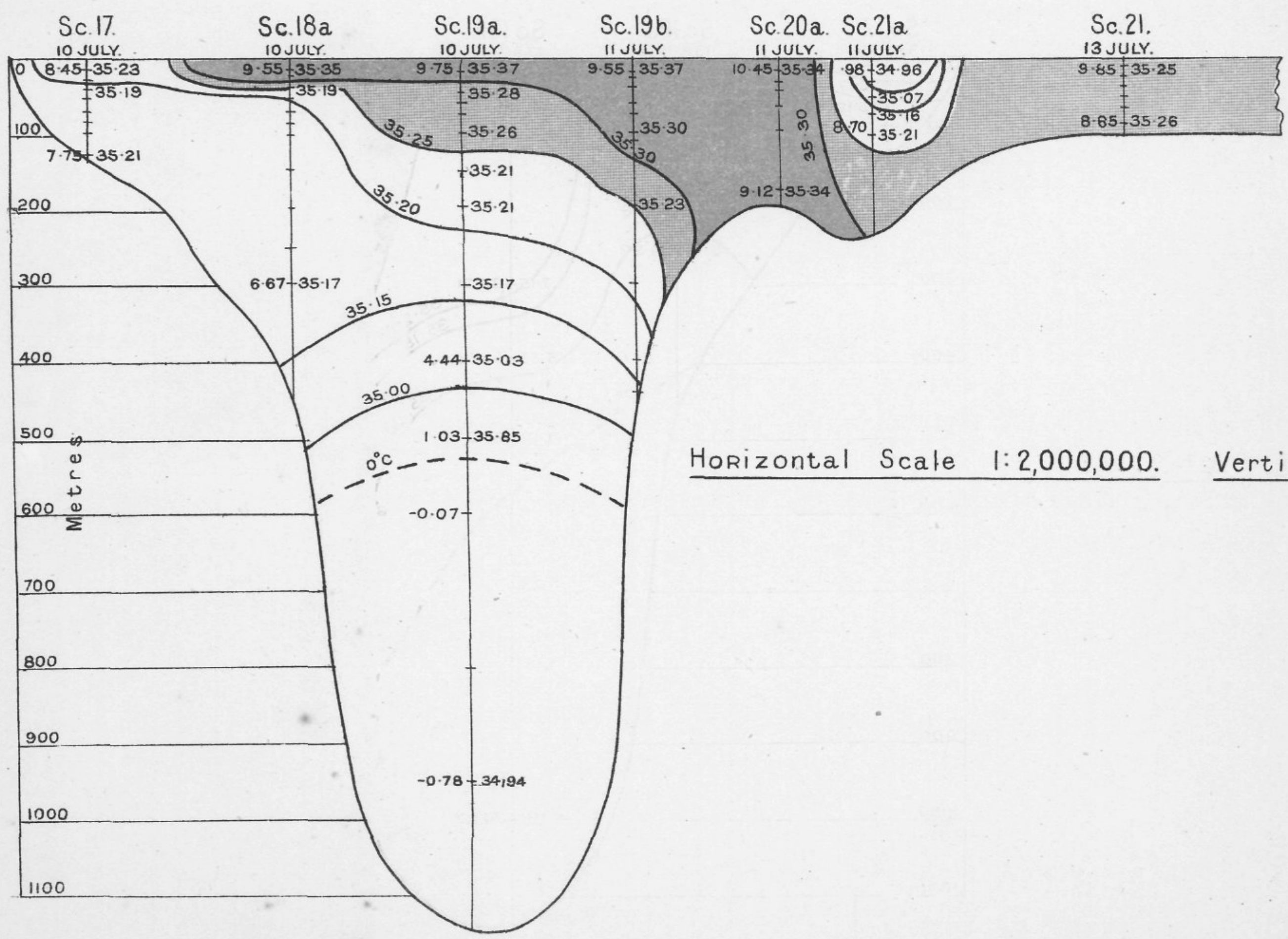

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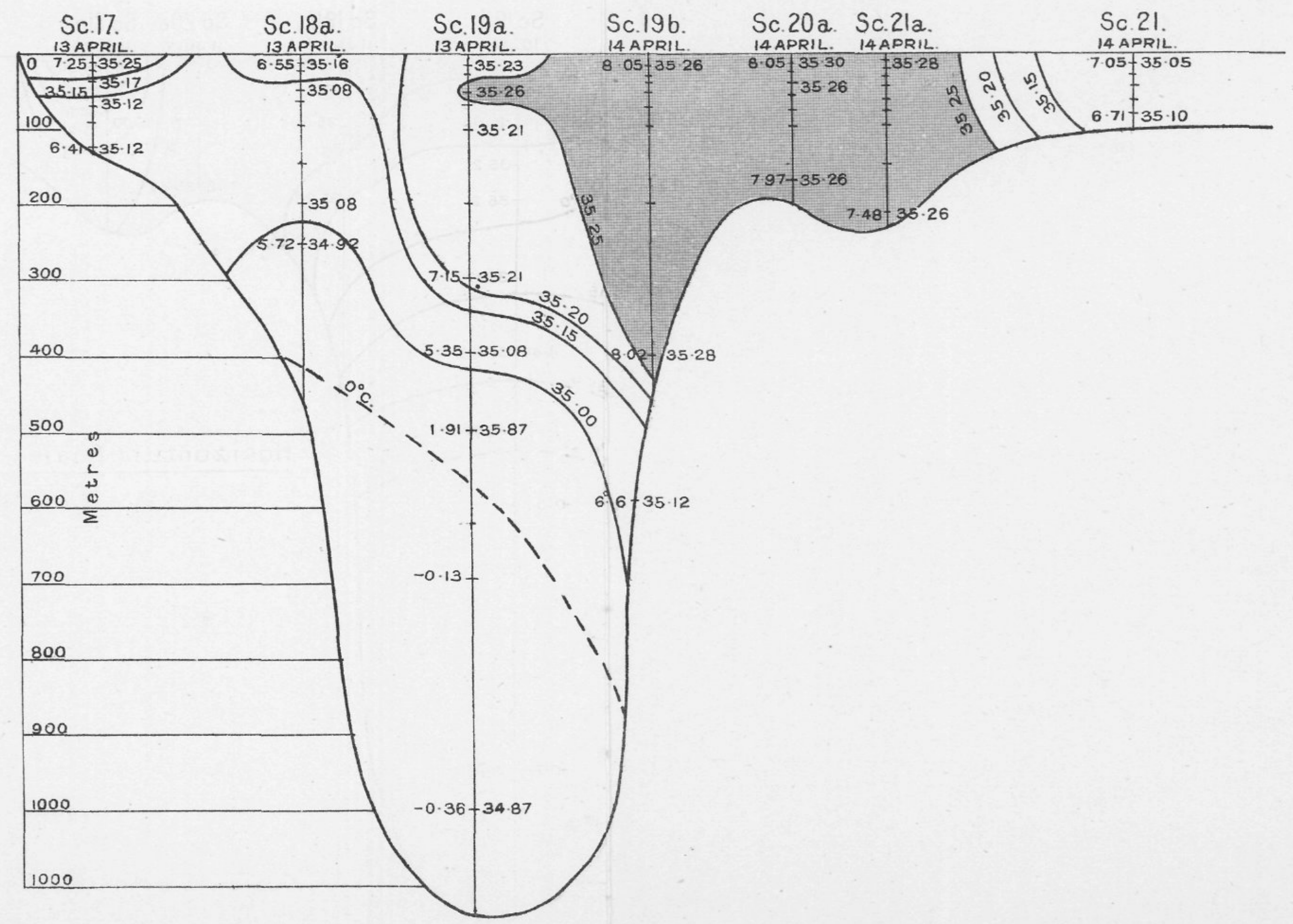

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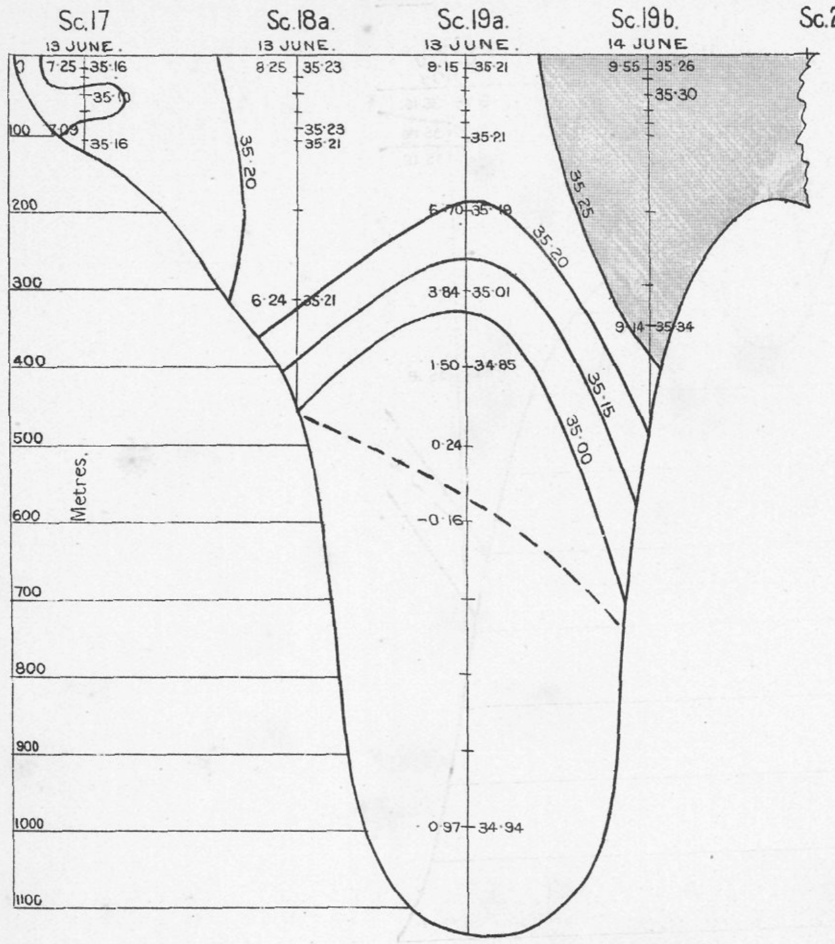

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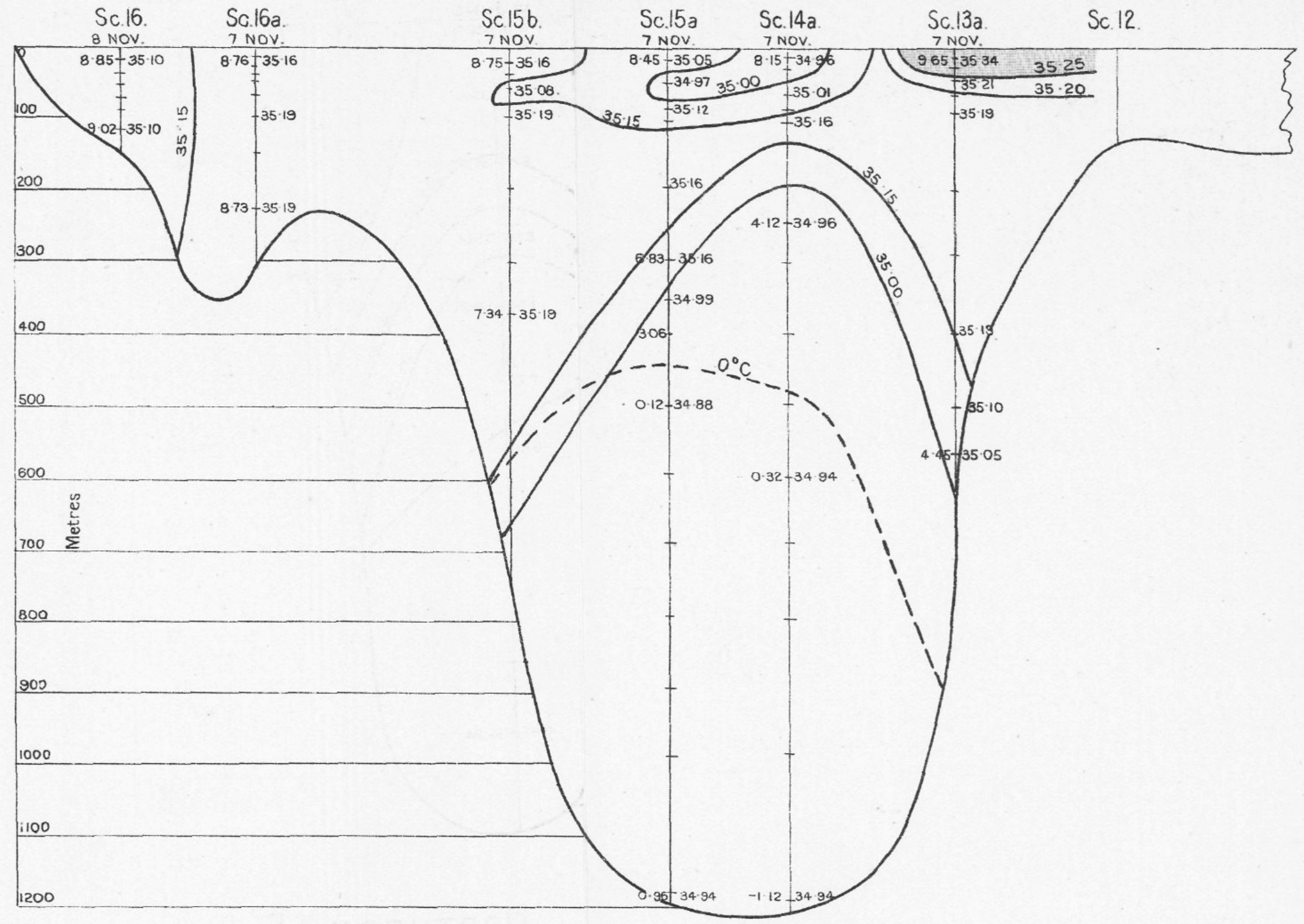

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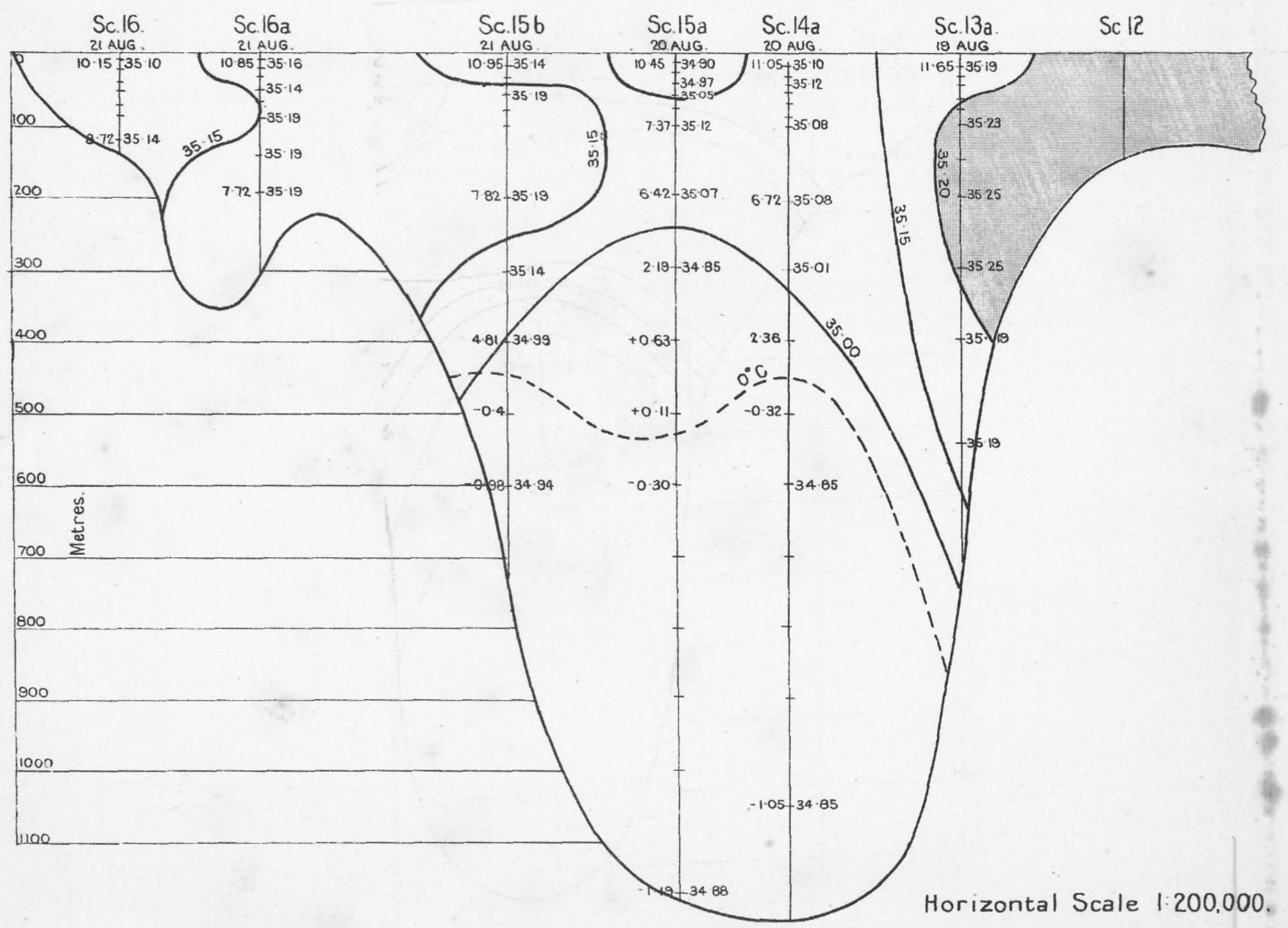

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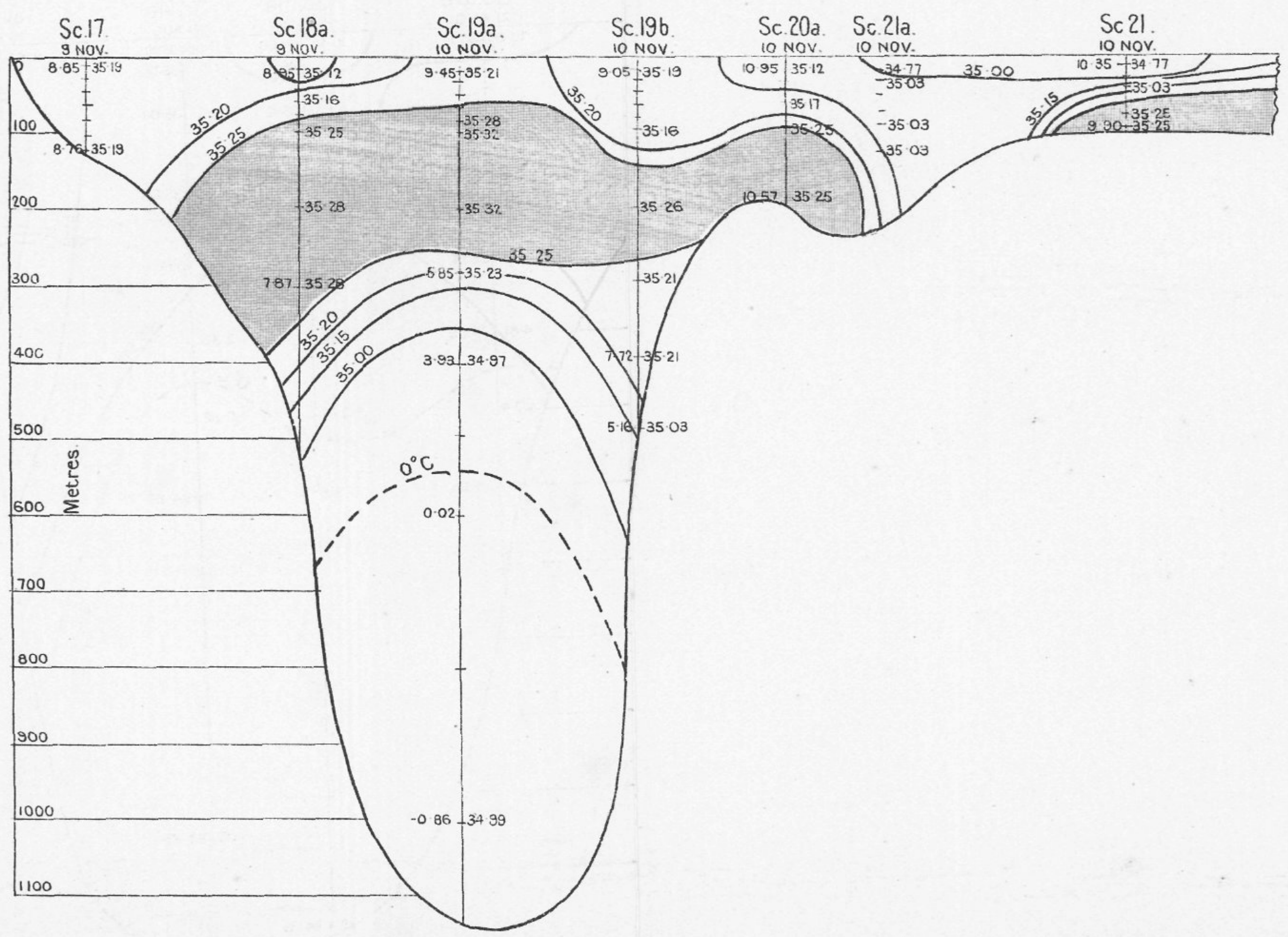

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