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REPORT

ON THE

P81

PHYSICAL CONDITIONS IN THE ENGLISH CHANNEL.

1903.

BY

DONALD J. MATTHEWS.

(WITH SIX PLATES.)

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Introduction.

The larger part of the hydrographical and Plankton investigations in the English Channel during the year 1903 have been carried out on the Marine Biological Association's steamers *Huxley* and *Oithona* in four quarterly cruises during the months of February, May, August, and November, the programme drawn up at the Second International Conference (Christiania, 1901) being adhered to as closely as circumstances permitted. In addition to this, a number of surface samples and temperatures have been obtained from other sources and have proved of great value in extending and interpreting the observations made on the regular cruises.

In May a series of surface samples and temperatures in the Channel were obtained for us by Dr. R. N. Wolfenden, the observations being made on his yacht *Silver Belle* by the master, Mr. Buchan Henry.

Samples and temperatures have been taken every fortnight since October 21st, 1903, between Newhaven and Caen, on the London, Brighton and South Coast Railway Company's steamers *Calvados*, Captain F. Banks, master, and *Trouville*, Captain R. G. Phillips, master. We have to thank Mr. Wylie, the Continental Manager of the line, for his courtesy in permitting these observations to be made, and Captain W. Morris, the Marine Superintendent, for the trouble he has taken in arranging the work generally.

In November it was wished to extend the area investigated to the Bay of Biscay, and Sir A. L. Jones, K.C.M.G., on being applied to, referred us to Captain Thompson, Marine Superintendent of the African Steamship Company, who arranged for a set of samples to be taken on the s.s. *Loanda*, Captain Hough.

Samples in the Bay of Biscay and off the coast of Portugal were taken during this month by Mr. F. B. Allen, chief engineer of the s.s. *Eastfield*.

On the line from Land's End to Cork samples were taken by Captain F. Ridge, of the s.s. *Xenia* Cork Steamship Company.

Finally, we have to thank Mr. G. P. Farran, naturalist on board the s.s. *Helga*, of the Fisheries Branch of the Department of Agriculture and Technical Instruction for Ireland, for a set of samples and temperatures off the south coast of Ireland.

We wish here to tender our thanks to all concerned in the above observations.

Two sets of observations every two hours during 24 hours were made on Station I. on the *Oithona*.

The work done on the fixed stations was as follows :—

A sounding was taken to determine the depth and nature of the bottom.

Observations of temperature were made and samples of water collected at the surface, 5, 10, 15, 20, 30, 40, 50, 75, &c., metres, and at the bottom, or as close to the bottom as it was considered safe to send the water bottle under the particular conditions.

Samples of plankton were collected at the surface and at various depths.

Observations were made of the temperature, pressure, and humidity of the air, and of the other meteorological conditions.

At various points between the stations observations of the surface temperature were made and samples of water collected and the meteorological conditions recorded. It had originally been intended to make these intermediate observations every two hours, and this was actually done during the February (1903) cruise. Afterwards, they were made at such times as seemed likely to give the most valuable results. For instance, when running from Plymouth to Ushant across the isotherms and isohalines, surface temperatures were read more often than every two hours as the average speed of the boat was eight knots, and such intervals would be far too long. On the other hand, less attention was given to observations on lines parallel to the isotherms, as a very small error in the ship's distance from the shore would make them nearly useless.

The surface temperature was read by drawing a bucket of water over the side, taking care to keep clear of any discharge from the ship. In February a metal bucket was used; later, one of leather was substituted. The use of a leather bucket is advantageous for taking temperatures, but it is more likely to contain dried salt in the crevices, and accordingly great attention was paid to rinsing it out thoroughly if a sample of the water was to be preserved for analysis. The thermometer used for surface temperatures was by Richter, of Berlin, divided to 0·10° C. on a milk-glass scale. The table of corrections was supplied by the Physikalisch Technische Reichsanstalt, of Charlottenburg, according to the air thermometer scale, the maximum error being 0·03° C.

It is doubtful whether surface observations are to be trusted to less than 0·5° C., and for this reason the isotherms have been drawn to whole degrees only. The point is further discussed in the account of the observations at Station I. for a period of 24 hours.

Below the surface, temperatures were determined and samples collected with the Nansen-Pettersson water bottle. This consists of a cylindrical body containing several concentric tubes of non-conducting material separated by distance pieces. It can be closed at top and bottom by stoppers of considerable thickness, divided into separate compartments by rubber washers. A thermometer is inserted through the upper stopper so that when the water bottle is closed the bulb projects below the washers into the central compartment. A tap for drawing off the water is fixed to the lower stopper. The water bottle is sent down open to the desired depth, and allowed to remain there long enough to take the temperature of the surrounding water. A messenger is then sent down the line to close the bottle, which is hauled up on deck for the temperature to be read. The insulation period of the water bottle was originally about seven minutes, *i.e.*, no rise of the mercury as great as 0·01° C. was observed in that time when the outside temperature was 5° or 6° above that of the water. Afterwards it was reduced in the case of one bottle to about six minutes by some alterations that had to be made when the rubber washers were renewed. The thermometers used were by Richter, and were supplied with a Charlottenburg certificate. They were divided to 0·10° C., and were protected against the pressure of the water by an outer glass tube. When the sea was calm the temperature could be easily read to 0·01° C., and readings made in duplicate by the writer and Mr. Pace did not differ by this amount under favourable conditions ; but in a rough sea the error is probably 0·02° C. at the least owing to the difficulty of holding the apparatus sufficiently steady to avoid parallax. The error due to cooling by the expansion of the water when brought up from great depths is negligible in the shallow waters of the Channel. The water bottle only once failed to close at the proper time, and the difference in the blow of the messenger could be plainly distinguished through the wire.

Soundings were made with a 30-lb. lead, armed with tallow, on the line that was used for the water bottle, a flexible steel cord of about 1,000 lbs. breaking strain. The amount of wire paid out was measured by passing it over a metre wheel fitted with a counting apparatus.

The thermometers, water bottles, and metre wheels were supplied by the Central Laboratory at Christiania.

The barometers were of the mercurial marine pattern, and were supplied by the Meteorological Office. A Richard recording barograph was also used, but its readings have only been entered in the tables in the cases of two days work on the hired tug *Triton* in August, when it did not seem advisable to run the risk of damaging the mercurial barometer by unshipping and carrying it by rail.

The temperature and humidity of the air were measured by Dr. Assmann's aspiration psychrometer. This is a wet and dry bulb thermometer, each bulb being protected from radiation by two concentric cylinders of polished metal. The cylinders are open below, while above they lead into a single tube through which a current of air is sucked by a fan driven by clockwork. The wet bulb is covered with muslin, and is wetted before use by means of a pipette. The thermometers, by Feuss, of Steglitz-bei-Berlin, are divided to 0·2° C. on a milk glass scale. No readings are given beyond the first place of decimals, and they are probably not to be trusted to such a degree of accuracy, certainly not in the case of those taken in February when the liability to error by radiation from the deck on to the unshielded ends of the bulbs was not fully recognised. The humidity is calculated from the formula $f = f^1 - \frac{1}{2}(t - t^1)\frac{b}{755}$, but the correction for the height of the barometer was not applied, being negligible in comparison with the many other causes of error which were unavoidable.

The force of the wind was estimated according to the Beaufort scale.

The routine of work on a station was as follows :—

A sounding was made with the lead, armed with tallow, on a steel wire, the amount run out being measured on a metre wheel. The depth and nature of the bottom were recorded.

The lead was then removed and the water bottle fastened on in its place, and temperatures were read and water samples collected at various depths, beginning at the bottom and ending at five metres. This occupied from one to two hours, depending on the depth and condition of the sea. The water bottle was removed and another sounding was made. The vertical haul net was then bent on to the wire, let down to the bottom, and hauled straight up. The ship was then put on the other tack and the closing Garstang net was worked on a similar wire on the other side of the ship. In every case gear was worked from the weather side to avoid the danger of the ship drifting over it and causing the line to foul the keel. Finally, the surface nets were towed astern for 10 minutes. While the plankton work was being carried out the meteorological observations were made. The total time occupied on a station was from two to five hours.

Analysis of the Water Samples.

The bottles used for the water samples were 35-oz. squat form, light green glass stoppered Winchesters, packed in boxes containing two dozen. Each bottle was numbered by painting large black figures on the side with spirit varnish, the number being entered in the deck book against the temperature, depth, position, &c., as soon as a sample had been taken. When a box was full, all the stoppers were tied down with parchment paper before being stowed in the hold.

The examination of the water on shore was confined to a determination of the chlorine, Volhard's method being used for samples collected in February and May, and since then the chromate volumetric method. The chromate method, while not so sensitive as Volhard's method, is very much quicker, and the risk of error from fatigue when many samples are to be analysed is lessened. It has the additional advantage of giving excellent results by artificial light. The water was measured in a pipette of the Knudsen pattern, *i.e.*, one provided with a three-way stop-cock instead of an upper mark. The capacity of this pipette was 16·96 normal c.cm. The variation in the weight of distilled water delivered, when corrected for temperature, was about 2 millegrams, or $\frac{1}{8500}$. When Volhard's method was employed, the silver nitrate solution was delivered from a Knudsen pipette, the capacity of which was 47·568 normal c.cm. and was of such a strength as to be in slight excess. The sea water and silver were mixed in amber glass medicine bottles, acidified with nitric acid, made up to 100 c.cm., and after thorough shaking were allowed to stand overnight. Next morning 50 c.cm. of the clear supernatant fluid were removed with a pipette and titrated with a solution of ammonium thiocyanate, iron alum being used as an indicator. The accuracy of the results when the analysis is carried out thus depends partly on always working under the same conditions, and partly on the excess of silver being small, so that the error in making up the liquid to 100 cc. should have little effect on the final value. The solutions were standardized for every ten samples analysed by means of a standard sea water, supplied in sealed tubes, at first by Dr. Martin Knudsen, of the Central Bureau at Copenhagen, afterwards by the Central Laboratory at Christiania.

Three samples from each of the cruises were sent to the Central Laboratory for control analysis, and the results were as follows :—

TABLE 1.

February 1903.

Sample N°.	143.	201.	278.
1. Chlorine ... ... (Plymouth).	19·671°/₀₀	19·631°/₀₀	19·641°/₀₀
2. Specific gravity $\frac{0°}{4°}$ ... (Christiania).	1·028535	1·028515	1·028510
3. Chlorine deduced from 2 ...	19·65°/₀₀	19·64°/₀₀	19·64°/₀₀
Difference in Chlorine	+ 0·02	− 0·01	0·00

The specific gravity was determined at the Central Laboratory by means of a total immersion hydrometer, the results being rounded off to 5 in the last place of decimals. Dr. Nansen reports that the bottles in which the samples were sent were not very suitable, and that therefore no very great reliance is to be placed in the figures given above.

TABLE 2.

May 1903.

Plymouth N°. Central Lab. N°.	299. C.L. 1.	475. C.L. 2.	336. C.L. 3.
1. Chlorine ... ... (Plymouth).	19·536°/₀₀	19·670°/₀₀	19·562°/₀₀
2. Specific gravity $\frac{0°}{4°}$ ... (Christiania).	1·028402	1·028597	1·028439
3. Chlorine by Volhard's method (Christiania).	19·558°/₀₀	19·698°/₀₀	19·586°/₀₀
4. Chlorine from 2	19·564°/₀₀	19·698°/₀₀	19·589°/₀₀
Difference 1 and 3 ...	− 0·022°/₀₀ Cl.	− 0·028°/₀₀ Cl.	− 0·024°/₀₀ Cl.
Difference 1 and 4 ...	− 0·028°/₀₀ Cl.	− 0·028°/₀₀ Cl.	− 0·027°/₀₀ Cl.

The control samples for May were sent in bottles with porcelain stoppers fitted with rubber washers, the whole being kept in position by spring catches. A difference of 0·028°/₀₀ chlorine corresponds to 0·058°/₀₀ salinity, which is the limit of error allowed by the programme of the International Conference. The results may be considered sufficiently accurate for the object in view, and agree well among themselves ; but the uniformity of the difference for the May samples points to some constant cause of

disagreement, which will be further investigated. The instruments used have been carefully calibrated in the Plymouth Laboratory, and no uncertainty has been found in their capacity which could account for the differences observed, while an error in the absolute values of the gramme weights, which agree well among themselves, would affect all pieces of apparatus equally and therefore not influence the final result. The fact that there is no difference as great as $0{\cdot}01\,^{\circ}/_{\circ\circ}$ chlorine between the observed and the calculated values of the Central Laboratory shows that Knudsen's Hydrographical Tables are applicable to Channel waters without any appreciable error.

Since August the chromate titration process has been used, and no control analyses have yet been received from the Central Laboratory. The pipette for the sea water was the one described above. The burette was of the bulb form, drawn out to a fine point above, and provided with a three way stopcock for connection to the stock bottle. The capacity of the bulb was 49·862 c.cm., and of the divided part 2·0 c.cm., the volume between two divisions being 0·02 c.cm.

All samples have been been analysed in duplicate, which ever method was employed. The maximum difference allowed was $\frac{1}{2500}$ for Volhard's method, and $\frac{1}{1700}$ for the chromate method.

TABLE 3.

List of Stations.

Number.	Latitude.	Longitude.	——	Number.	Latitude.	Longitude.	——
E. 1.	50° 2′ N.	4° 22′ W.		E. 13.	50° 20′ N.	1° 15′ W.	
E. 2.	49° 27′ N.	4° 42′ W.		E. 14.	50° 33′ N.	1° 17′ W.	
E. 3.	48° 34′ N.	5° 13′ W.		E. 15.	50° 27′ N.	1° 50′ W.	
E. 4.	48° 27′ N.	6° 35′ W.		E. 16.	50° 23′ N.	2° 28′ W.	
E. 5.	49° 6′ N.	6° 32′ W.		E. 17.	50° 11′ N.	2° 52′ W.	
E. 6.	50° 24′ N.	6° 5′ W.	Not worked in August.	E. 18.	50° 23′ N.	3° 8′ W.	
E. 7.	49° 53′ N.	5° 38′ W.		E. 19.	49° 56′ N.	3° 23′ W.	
E. 8.	49° 16′ N.	3° 37′ W.		E. 20.	50° 8′ N.	3° 47′ W.	
E. 9.	49° 39′ N.	3° 9′ W.		E. 21.	50° 21′ N.	0° 19′ W.	Not worked in February.
E. 10.	49° 49′ N.	2° 33′ W.		E. 22.	50° 33′ N.	0° 36′ E.	Not worked in February.
E. 11.	50° 5′ N.	1° 58′ W.		E. 23.	51° 11′ N.	1° 37′ E.	Only worked in May.
E. 12.	49° 55′ N.	1° 9′ W		E. 24.	50° 0′ N.	0° 21′ E.	Only worked in November.

February Cruise.

S.S. *Huxley*.—Captain H. H. Caspersen.

Left Plymouth February 5th, 3.45 p.m. Staff: E. J. Allen, D.Sc., Director, in charge; R. A. Todd, B.Sc., Zoologist; and D. J. Matthews, Hydrographer. Mr. W. I. Beaumont was on board as a guest. Worked stations E. 1 to E. 7, and returned to Plymouth February 9th, 10 p.m.

Left Plymouth February 10th, 5.15 p.m. Staff: D. J. Matthews, Hydrographer, in charge; R. A. Todd and S. Pace, Zoologists. Worked stations E. 8 to E. 20, and returned to Plymouth February 14th, 10.30 p.m.

May Cruise.

S.S. *Oithona*.—Captain W. James.

Left Plymouth May 2nd, 6 a.m. D. J. Matthews, Hydrographer, in charge; L. H. Gough, Ph.D. and S. Pace, Zoologists. Worked stations E. 1 and E. 2. Put into Dartmouth 10 p.m. on the same day for shelter.

Left Dartmouth May 4th, 1 a.m., and worked stations E. 19, E. 18, E. 17, E. 16, and E. 15. Put into Cowes for coal and water May 5th, 0.30 p.m. Weighed anchor February 6th, 4 a.m., and worked stations E. 14 and E. 13. The weather looking threatening, put back for shelter, and anchored in St. Helen's Roads 9 p.m. Weighed anchor May 7th, 6 a.m., and steamed to Ryde Roads; anchored 6.45 a.m. Proceeded to sea 10.30 p.m. the same day, and worked stations E. 12, E. 11, E. 10, E 9, and E. 8. Returned to Plymouth May 9th, 11 p.m.

S.S. *Huxley*.—Captain H. H. Caspersen.

Left Plymouth May 13th, 6 p.m. Staff: D. J. Matthews and Dr. Gough. Worked stations E. 1 to E. 7, and returned to Plymouth May 17th, 6.30 a.m.

Left Plymouth May 18th. Staff: D. J. Matthews. Worked stations E. 21, E. 22, and E. 23. Moored in Lowestoft Harbour May 20th, 1.45 p.m.

August Cruise.

S.S. *Oithona*.—Captain J. Sanders.

Left Plymouth August 5th, 0.9 p.m. Staff: D. J. Matthews, Hydrographer, in charge, and W. R. G. Bond, B.A., Zoologist. Worked stations E. 8 to E. 14, E. 22, E. 21, E. 15, and E. 16. Owing to bad weather, put into Brixham August 9th, at noon. Took in coal and water, and left August 10th, 2 p.m. Worked station E. 18, and put into Dartmouth for shelter 9 p.m. the same day.

Left Dartmouth August 12th, 8 a.m., and worked stations E. 17, E. 19, and E. 20. Put into Plymouth August 13th, 6 a.m.

No work could be done till August 25th owing to the weather.

Left Plymouth August 26th, 4 a.m. Staff: D. J. Matthews, in charge, and Dr. Gough. Worked stations E. 1 and E. 2, and set course for Lizard to report by signal. Put into Newlyn August 27th, 6 a.m.

Left Newlyn August 28th, 9 a.m., and worked station E. 7. The weather continuing unsettled, put into Falmouth and put gear in store.

Left Falmouth for Plymouth August 29th, 11 a.m.

Tug *Triton*.—Captain White.

Transferred gear to *Triton* at Falmouth. Left Falmouth September 1st, 6.20 a.m. Staff as before. Worked stations E. 3, E. 4, and E. 5. Returned to Plymouth September 2nd, 10 p.m.

November Cruise.

S.S. *Huxley*.—Captain H. H. Caspersen.

Left Plymouth November 3rd, 4.45 a.m. Staff: D. J. Matthews, in charge, and S. Pace. Worked stations E. 1 to E. 5. Put into St. Ives Bay for shelter November 6th, 5 p.m. Weighed anchor November 7th, 7 a.m., and worked stations E. 6 and E. 7. Anchored in Plymouth Sound November 8th, 7.30 a.m.

Left Plymouth November 9th, 4 a.m. Staff: D. J. Matthews, S. Pace, and Dr. Gough. Worked stations E. 8 to E. 11, E. 24, and E. 12 to E. 20. Returned to Plymouth November 14th, 8 a.m.

Left Plymouth November 17th, 6 a.m. Staff: W. Garstang, M.A., in charge; D. J. Matthews; and T. C. Jerrom. Trawled on various grounds, and worked stations E. 21 and E. 22. Moored in Lowestoft Harbour November 20th, 6.30 p.m.

DISCUSSION OF OBSERVATIONS OBTAINED ON QUARTERLY CRUISES.

The surface observations, &c., obtained on the quarterly cruises are given in Table 4, each cruise being tabulated by itself. The first column contains the date; the second, the Greenwich time; the third and fourth, the latitude and longitude; the fifth, the surface temperature; the sixth, the salinity in parts per thousand by weight, calculated by means of Knudsen's Tables from the chlorine determinations, according to the formula $S = 0{\cdot}030 + 1{\cdot}8050\,Cl.$; the seventh, σ_0, where $\sigma_0 = (S_0 - 1)\,1000$, S_0 being the specific gravity of the sea water at 0° C. referred to distilled water at 4° C. (Knudsen's Tables); the eighth and ninth, the height of the barometer in inches and millemetres, reduced to standard conditions; the tenth and eleventh, the readings of the dry and wet bulbs of the thermometers of Assmann's aspirator; the twelfth, the humidity of the atmosphere calculated from the last two data; the thirteenth, the direction of the wind (true); the fourteenth and fifteenth, the force of the wind according to the Beaufort scale and in metres per second; the sixteenth and seventeenth, the condition of the sea and sky; while the last shows if the observations were taken on a station.

Table 5 gives temperature observations and salinities, &c., of the surface water collected by various steamships during the November cruise.

TABLE 4.

FEBRUARY, 1903.—S.S. *Huxley*.

Date.	Time.	Latitude.	Longitude.	Surface.			Barometer.		Air.			Wind.			Sea.	Sky.	—
				t.° C.	S.°/₀₀	σ_0	in.	m/m.	Dry Bulb.	Wet Bulb.	H.°/₀	Direction.	Force. B.	Force. m/s.			
5	9.30 p.m.	50° 2′ N.	4° 22′ W.	9·30	35·35	28·41	30·22	767·6	8·5	6·6	76	S. 30° W.	—	—	Moderate	—	Station E.1.
6	2 a.m.	49° 54′ N.	4° 24′ W.	9·63	—	—	30·09	764·3	8·1	6·4	78	S. 30° W.	3	4	Moderate	c.	—
6	4 a.m.	49° 49′ N.	4° 29′ W.	9·67	—	—	30·09	764·3	9·6	7·8	78	S. 30° W.	3	4	Moderate	c.	—
6	6 a.m.	49° 37′ N.	4° 38′ W.	9·97	—	—	30·01	762·2	10·0	8·4	81	—	—	—	—	—	—
6	8 a.m.	49° 32′ N.	4° 40′ W.	10·57	—	—	30·11	764·8	10·1	9·3	90	S. 5° W.	2	2	Moderate	c.	—
6	Noon	49° 27′ N.	4° 42′ W.	10·26	35·44	28·48	29·96	760·9	10·5	9·4	87	S. 15° W.	5	8	Rough	c.	Station E.2.
6	2 p.m.	49° 34′ N.	4° 38′ W.	10·33	—	—	30·00	762·0	10·7	9·6	87	S. 30° W.	3	4	Moderate	c.	—
6	4 p.m.	49° 22′ N.	4° 47′ W.	10·43	—	—	29·96	760·9	11·2	10·2	88	S. 30° W.	3	4	Moderate	c.	—
6	6 p.m.	49° 11′ N.	4° 55′ W.	10·43	—	—	30·04	763·0	11·8	10·6	86	S. 30° W.	2	2	Moderate	c.	—
6	8 p.m.	48° 58′ N.	5° 5′ W.	10·30	—	—	30·07	763·5	11·2	10·5	92	S. 30° W.	2	2	Moderate	c.	—
6	10 p.m.	48° 47′ N.	5° 19′ W.	10·50	—	—	30·10	764·5	11·4	10·4	88	S. 30° W.	1	1	Smooth	c.	—
6	Midnight	48° 34′ N.	5° 13′ W.	10·52	35·52	28·54	30·11	764·8	11·0	10·2	90	S. 15° W.	3	4	Moderate	b.	Station E.3.
7	2 a.m.	48° 34′ N.	5° 13′ W.	10·48	—	—	30·13	765·3	10·8	10·2	90	—	—	—	—	—	Station E.3.
7	6 a.m.	48° 32′ N.	5° 26′ W.	10·60	—	—	30·11	764·8	11·1	10·1	88	—	—	—	—	—	—
7	8 a.m.	48° 32′ N.	5° 43′ W.	10·60	—	—	30·12	765·0	11·2	10·4	91	S. 45° W.	—	—	—	—	—
7	10 a.m.	48° 32′ N.	6° 1′ W.	10·68	—	—	30·11	764·8	11·4	10·7	92	S. 45° W.	2	2	Swell	b.	—
7	Noon	48° 31′ N.	6° 23′ W.	10·73	—	—	30·11	764·8	11·8	11·0	91	—	—	—	—	—	—
7	2.30 p.m.	48° 25′ N.	6° 35′ W.	10·58	35·41	28·46	30·19	766·8	11·38	10·6	91	S. 15° W.	5	8	Moderate	o.	Station E.4.
7	8 p.m.	48° 38′ N.	6° 28′ W.	10·48	—	—	30·20	767·1	11·0	10·1	89	—	—	—	—	—	—
7	10 p.m.	48° 52′ N.	6° 29′ W.	10·02	—	—	30·17	766·3	11·2	10·4	90	S. 30° W.	—	—	Moderate	b.	—
7	Midnight	49° 6′ N.	6° 31′ W.	9·88	35·39	28·44	30·13	765·3	10·6	9·9	92	S. 50° W.	6	10·5	Rough	o.	Station E.5.
8	4 a.m.	49° 9′ N.	6° 27′ W.	9·89	—	—	30·18	766·6	10·7	10·0	92	S. 50° W.	6	10·5	—	—	—
8	6 a.m.	49° 17′ N.	6° 24′ W.	9·89	—	—	30·22	767·6	11·0	10·3	92	—	—	—	—	—	—
8	8 a.m.	49° 33′ N.	6° 15′ W.	9·78	—	—	30·22	767·6	10·6	10·2	95	—	—	—	—	—	—
8	10 a.m.	49° 47′ N.	6° 7′ W.	9·58	—	—	30·23	767·8	10·4	10·1	96	—	—	—	—	m.	—
8	Noon	49° 54′ N.	6° 4′ W.	9·43	—	—	30·20	767·6	10·4	10·1	96	S. 30° W.	2	2	Slight	f. d.	Lying to.
8	2 p.m.	—	—	9·40	—	—	30·27	768·8	10·4	10·1	96	—	—	—	—	f. dense	Lying to.
8	4 p.m.	—	—	9·38	—	—	30·28	769·1	10·4	10·1	96	—	—	—	Moderate	f. dense	Lying to.
8	6 p.m.	49° 55′ N.	5° 49½′ W.	9·36	—	—	30·34	770·6	10·4	10·0	95	—	—	—	—	Clearing	—
8	10 p.m.	49° 53′ N.	5° 38′ W.	9·88	35·41	28·46	30·18	766·6	10·7	10·0	92	S. 40° W.	3	4	Swell	—	Station E.7.
8	Midnight	50° 3′ N.	5° 55′ W.	9·38	—	—	—	—	10·2	9·6	93	S. 40° W.	4	6	Moderate	—	—
9	4 a.m.	50° 25′ N.	6° 5′ W.	9·39	—	—	30·34	770·6	10·0	9·4	93	—	—	—	—	—	—
9	6 a.m.	50° 24′ N.	6° 5′ W.	9·39	35·41	28·46	30·34	770·6	10·0	9·6	95	S. 60° W.	6	10·5	Moderate	m.	Station E.6.
9	8 a.m.	50° 23′ N.	6° 4′ W.	9·30	—	—	30·44	773·2	9·9	9·8	96	S. 70° W.	3	4	Slight	d.	—
9	10.30 a.m.	50° 15½′ N.	5° 56′ W.	9·38	—	—	30·49	774·4	10·0	9·7	96	S. 40° W.	—	—	—	d.	—
9	4 p.m.	49° 56′ N.	5° 12′ W.	9·58	—	—	30·58	776·7	10·1	9·5	93	—	—	—	—	—	—
10	10 p.m.	49° 50′ N.	3° 58′ W.	9·93	—	—	30·66	778·7	9·8	9·1	91	—	—	—	—	—	—
10	Midnight	49° 34′ N.	3° 53′ W.	9·98	—	—	30·66	778·7	10·4	9·6	90	—	—	—	Smooth	b.	—
11	2 a.m.	49° 16′ N.	3° 37′ W.	9·78	35·41	28·46	30·64	778·2	9·4	8·6	90	—	—	—	Smooth	b.	Station E.8.
11	8 a.m.	49° 16′ N.	3° 43′ W.	9·29(?)	—	—	30·64	778·2	8·6	7·4	85	—	—	—	—	—	—
11	10 a.m.	49° 30′ N.	3° 15′ W.	9·58	—	—	30·64	778·2	9·6	8·6	88	S. 40° W.	1	1	Slight swell	o.	—
11	Noon	49° 39′ N.	3° 9′ W.	9·78	35·45	28·49	30·52	775·2	8·63	7·90	91	S. 40° W.	1	1	Slight swell	o.	Station E. 9.
11	3.30 p.m.	49° 39′ N.	3° 10′ W.	9·73	—	—	30·57	776·5	7·9	7·2	91	—	—	—	—	—	—
11	6.35 p.m.	49° 49′ N.	2° 33′ W.	9·40	35·46	28·50	30·54	775·7	8·0	7·2	90	—	—	—	—	—	Station E.10.
12	2.30 a.m.	50° 5′ N.	1° 57′ W.	9·21	—	—	30·52	775·2	8·4	7·4	87	—	—	—	—	—	—
12	3 a.m.	50° 5′ N.	1° 58′ W.	9·09	35·48	28·51	30·53	775·5	8·4	7·4	87	N. 65° W.	4	6	Moderate	o.	Station E.11.

TABLE 4—*continued.*

FEBRUARY, 1903.—S.S. *Huxley—continued.*

Date.	Time.	Latitude.	Longitude.	Surface.			Barometer.		Air.			Wind.			Sea.	Sky.	——
				t.° C.	S.°/₀₀	σ_0	in.	m/m.	Dry Bulb.	Wet Bulb	H.°/₀	Direction.	Force. B.	Force. m/s.			
12	6 a.m.	50° 4′ N.	2° 4′ W.	9·07	—	—	30·43	772·9	8·4	7·4	87	—	—	—	—	—	—
12	10 a.m.	49° 55′ N.	1° 9′ W.	8·87	35·28	28·35	30·41	772·4	8·8	7·35	83	N. 65° W.	4	6	—	o.	Station E. 12.
12	2 p.m.	50° 11′ N.	1° 15′ W.	9·24	—	—	30·37	771·4	9·8	8·8	88	N. 60° W.	4	6	Moderate	—	—
12	4 p.m.	50° 15′ N.	1° 16′ W.	7·81	—	—	30·24	768·1	9·25	8·4	89	N. 60° W.	4	6	Moderate	—	—
12	6 p.m.	50° 20′ N.	1° 15′ W.	7·48	35·21	28·30	30·37	771·4	8·35	8·0	95	N. 65° W.	4	6	Moderate	m.	Station E. 13.
12	10 p.m.	50° 33′ N.	1° 17′ W.	7·67	35·23	28·31	30·40	772·1	8·63	7·40	85	N. 65° W.	4	6	Smooth	c.	Station E. 14.
13	2 a.m.	50° 30′ N.	1° 30′ W.	7·68	—	—	30·45	773·4	7·0	5·4	79	N. 10° W.	3	4	Smooth	b.	—
13	6 a.m.	50° 27′ N.	1° 50′ W.	8·36	35·39	28·44	30·58	776·7	5·70	5·20	93	N. 5° E.	2	2	Smooth	o. m.	Station E. 15.
13	8 a.m.	50° 26′ N.	1° 43′ W.	8·19	—	—	30·45	773·4	5·9	5·2	90	—	—	—	—	—	—
13	Noon	50° 23′ N.	2° 28′ W.	8·00	35·15	28·25	30·53	775·5	8·1	6·3	77	Calm	—	—	Smooth	m.	Station E. 16.
13	4 p.m.	50° 20′ N.	2° 37′ W.	8·85	—	—	30·48	774·2	8·7	6·5	73	N. 5° E.	1	1	Smooth	b.	—
13	6 p.m.	50° 11′ N.	2° 52′ W.	9·40	35·42	28·47	30·47	773·9	8·2	6·1	74	N. 5° E.	2	2	Smooth	b.	Station E. 17.
13	10 p.m.	50° 17′ N.	2° 54′ W.	8·58	—	—	30·47	773·9	7·9	6·2	78	N. 10° W.	1	1	Smooth	b.	—
13	Midnight	50° 23′ N.	3° 8′ W.	8·55	35·26	28·34	30·54	775·7	6·9	5·1	76	N. 10° W.	2	2	Smooth	b.	Station E. 18.
14	6 a.m.	50° 12′ N.	3° 16′ W.	8·48	—	—	30·34	770·6	6·5	5·4	85	S. 80° W.	1	1	Smooth	c.	—
14	9 a.m.	49° 56′ N.	3° 25′ W.	9·64	35·49	28·52	30·30	769·6	8·8	7·25	81	S. 50° W.	2	2	Smooth	b.	Station E. 19.
14	2 p.m.	50° 2′ N.	3° 36′ W.	9·43	—	—	30·28	769·1	8·8	7·1	79	N. 60° W.	2	2	—	—	—
14	4 p.m.	50° 8′ N.	3° 47′ W.	9·07	35·25	28·32	30·24	768·1	8·8	6·9	77	N. 65° W.	3	4	Smooth	c.	Station E. 20.

MAY, 1903.—S.S. *Oithona.*

1	6 p.m.	50° 13′ N.	4° 14′ W.	9·69	35·30	28·37	—	—	—	—	—	—	—	—	Rough	—	—
2	9.22 a.m.	50° 2′ N.	4° 22′ W.	10·20	35·44	28·48	29·61	752·1	11·00	9·70	85	—	—	—	Smooth	Hazy	Station E. 1.
2	2 p.m.	50° 3′ N.	4° 17′ W.	10·07	—	—	29·54	750·3	10·9	9·6	85	S. 60° E.	5	8	Rough	o.	—
2	4 p.m.	50° 5′ N.	3° 56′ W.	9·83	—	—	29·53	750·1	11·0	9·6	84	S. 50° E.	5	8	Rough	o.	—
2	5.15 p.m.	50° 8′ N.	3° 47′ W.	9·86(?)	35·30	28·37	29·49	749·0	Forced to abandon work owing to rough sea.							o.	Station E. 20.
4	3.37 a.m.	50° 7′ N.	3° 30′ W..	9·63	—	—	29·23	742·4	10·4	9·7	92	E.	1	1	Swell	c.	—
4	7.15 a.m.	49° 56′ N.	3° 23′ W.	10·08	35·49	28·52	29·23	742·4	10·1	9·6	94	S. 85° E.	1	1	Slight	c.	Station E. 19.
4	10 a.m.	50° 4′ N.	3° 9′ W.	10·01	—	—	29·24	742·7	10·7	9·9	90	N. 50° E.	—	—	Slight	c.	—
4	11.50 a.m.	50° 11′ N.	2° 52′ W.	—	35·34	28·40	29·34	745·2	9·7	9·4	96	N. 20° E.	2	2	Smooth	d.	Station E. 17.
4	4 p.m.	50° 23′ N.	3° 8′ W.	9·97	35·27	28·35	29·23	742·4	10·1	9·1	88	N. 60° E.	1	1	Smooth	b.	Station E. 18.
4	8 p.m.	50° 22′ N.	2° 52′ W.	9·70	—	—	29·26	743·2	8·2	8·0	97	N. 20° W.	1	1	Smooth	m.	—
4	11 p.m.	50° 22′ N.	2° 41′ W.	9·76	—	—	29·23	742·4	8·9	8·7	97	Calm	—	—	Smooth	f. d.	—
5	0.50 a.m.	50° 23′ N.	2° 28′ W.	9·70	35·07	28·18	29·24	742·7	9·6	9·2	95	N. 70° E.	1	1	Smooth	d.	Station E. 16.
5	4 a.m.	50° 25′ N.	2° 13′ W.	9·71	—	—	29·27	743·4	9·7	9·3	95	N. 80° E.	1	1	Smooth	o. d.	—
5	8 a.m.	50° 27′ N.	1° 50′ W.	9·46	35·06	28·17	29·23	742·4	9·4	8·8	93	S.	1	1	Smooth	o. p.	Station E. 15.
5	10 a.m.	50° 41′ N.	1° 35′ W.	9·68	34·50	27·72	29·26	743·2	9·6	9·1	93	Nearly calm			Smooth	d.	—
6	10 a.m.	50° 33′ N.	1° 17′ W.	9·70	34·81	27·98	29·60	751·8	9·6	8·0	81	S. 20° W.	2	2	Slight	b.	Station E. 14.
6	Noon	50° 27′ N.	1° 15′ W.	9·60	—	—	29·53	750·1	10·5	9·4	87	S.	2	2	Smooth	o.	—
6	2 p.m.	50° 20′ N.	1° 15′ W.	9·48	35·07	28·18	29·62	752·3	9·45	8·80	92	S. 10° W.	2	2	Smooth	o.	Station E. 13.
6	4 p.m.	50° 11′ N.	1° 11′ W.	9·52	—	—	29·54	750·3	9·5	8·8	92	S. 30° W.	4	6	Slight	o. d.	—
6	5 p.m.	Weather threatening—altered course to run for Isle of Wight for shelter.															
8	8.7 a.m.	49° 55′ N.	1° 5′ W.	9·84	34·94	28·08	29·74	755·4	10·2	9·2	89	S. 60° E.	2	2	Smooth	b.	Station E. 12.
8	10 a.m.	49° 58′ N.	1° 24′ W.	10·17	—	—	29·67	753·6	10·3	9·5	90	S. 30° E.	2	2	Slight	b..	—
8	0.32 p.m.	50° 5′ N.	1° 58′ W.	10·14	35·37	28·43	29·73	755·1	10·2	9·3	89	S. 45° E.	4	6	Moderate	b.	Station E. 11.
8	4 p.m.	49° 58′ N.	2° 13′ W.	10·14	—	—	29·74	755·4	10·4	9·4	88	S. 40° E.	4	6	Moderate	b.	—
8	10 p.m.	49° 49′ N.	2° 33′ W.	9·93	35·30	28·37	29·77	756·1	9·4	8·6	90	S. 40° W.	1	1	Smooth	b.	Station E. 10.

TABLE 4—*continued.*

MAY, 1903.—S.S. *Oithona—continued.*

Date.	Time.	Latitude.	Longitude.	Surface.			Barometer.		Air.			Wind.			Sea.	Sky.	—
				t.° C.	S.°/₀₀	σ_0	in.	m/m.	Dry Bulb.	Wet Bulb.	H.°/₀	Direction.	Force. B.	Force. m/s.			
9	0.12 a.m.	49° 46′ N.	2° 43′ W.	9·79	—	—	29·69	754·1	9·6	8·9	91	S. 30° W.	1	1	Smooth	b.	—
9	2 a.m.	49° 39′ N.	3° 9′ W.	9·72	—	—	29·67	753·6	9·6	8·6	88	Calm	—	—	Smooth	b.	Station E. 9.
9	4 a.m.	49° 39′ N.	3° 9′ W.	9·72	35·32	28·38	29·73	755·1	9·3	8·6	92	S. 20° E.	1	1	Swell	b.	Station E. 9.
9	8 a.m.	49° 22′ N.	3° 30′ W.	10·28	—	—	29·71	754·6	10·3	8·8	82	S. 5° W.	2	2	Swell	b.	—
9	10 a.m.	49° 16′ N.	3° 37′ W.	10·47	35·37	28·43	29·92	759·9	9·9	8·5	83	S. 10° W.	1	1	Smooth	b.	Station E. 8.
9	Noon	49° 20′ N.	3° 40′ W.	10·63	—	—	29·72	754·9	11·1	8·6	72	N. 70° E.	1	1	Swell	b.	—
9	2 p.m.	49° 36′ N.	3° 47′ W.	10·79	—	—	29·70	754·4	10·4	8·4	77	N. 30° E.	1	1	Swell	b.	—
9	4 p.m.	49° 51′ N.	3° 55′ W.	11·39	—	—	29·71	754·6	11·2	9·3	79	N. 40° E.	1	1	Swell	c.	—
9	6 p.m.	50° 7′ N.	4° 2′ W.	11·17	—	—	29·71	754·6	—	—	—	S. 30° W.	1	1	Swell	c.	—
11	2 p.m.	50° 8′ N.	3° 47′ W.	10·23	35·32	28·38	29·94	760·5	9·68	7·8	77	N. 80° E.	2	2	Smooth	g.	Station E. 20.
11	8 p.m.	50° 2′ N.	4° 22′ W.	11·13	35·48	28·51	29·98	761·5	8·4	6·5	76	N. 5° W.	5	8	Moderate	c.	Station E. 1.

S.S. *Huxley.*

13	8 p.m.	50° 15′ N.	4° 12′ W.	10·38	—	—	29·98	761·5	10·8	9·4	83	—	—	—	Moderate	u.	—
13	Midnight	50° 2′ N.	4° 22′ W.	10·84	35·50	28·53	30·12	765·0	11·0	9·8	86	N. 80° W.	5	8	Moderate	c.	Station E. 1.
14	4 a.m.	49° 44′ N.	4° 32′ W.	10·26	—	—	30·01	762·2	10·2	9·6	92	S. 70° W.	4	6	Moderate	c.	—
14	8 a.m.	49° 27′ N.	4° 42′ W.	10·50	35·42	28·47	30·22	767·6	10·8	10·2	93	S. 70° W.	4	6	Moderate	c. g.	Station E. 2.
14	Noon	49° 11′ N.	4° 51′ W.	10·98	35·52	28·54	30·08	764·0	11·6	10·4	86	S. 50° W.	5	8	Moderate	c.	—
14	4 p.m.	49° 45′ N.	5° 2′ W.	11·17	35·57	28·59	30·30	769·6	11·2	9·6	82	S. 10° W.	—	—	Swell	c.	—
14	8.45 p.m.	48° 34′ N.	5° 13′ W.	11·31	35·53	28·56	30·34	770·6	11·6	10·4	86	S. 70° W.	2	2	Heavy swell.	c.	Station E. 3.
14	Midnight	48° 32′ N.	5° 28′ W.	11·17	35·60	28·61	30·26	768·6	11·5	10·4	87	S. 70° W.	1	1	Heavy swell.	c.	—
15	4.15 a.m.	48° 29′ N.	5° 49′ W.	11·07	35·59	28·60	30·23	767·8	11·6	10·2	84	S. 50° W.	2	2	Swell	c.	—
15	9 a.m.	48° 27′ N.	6° 35′ W.	11·32	35·55	28·57	30·34	770·6	11·6	10·5	87	S. 70° W.	4	6	Heavy swell.	b.	Station E. 4.
15	Noon	48° 30′ N.	6° 30′ W.	11·42	35 55	28·57	30·26	768·6	11·8	10·8	88	S. 60° W.	6	10·5	Rough	c.	—
15	4 p.m.	48° 58′ N.	6° 39′ W.	11·17	—	—	30·31	769·8	11·2	9·0	75	S. 75° W.	3	4	Moderate	c.	—
15	4.40 p.m.	49° 6′ N.	6° 32′ W.	11·08	35·30	28·37	30·42	772·6	11·2	9·0	75	W.	4	6	Moderate	b.	Station E. 5.
15	8 p.m.	49° 7′ N.	6° 31′ W.	11·02	—	—	30·34	770·6	10·75	8·70	77	N. 60° W.	2	2	Swell	c.	—
15	Midnight	49° 30′ N.	6° 14′ W.	11·12	35·44	28·48	30·35	770·9	10·6	8·2	72	N. 60° W.	3	4	Swell	b.	—
16	4 a.m.	50° 3′ N.	6° 2′ W.	10·12	35·34	28·48	30·30	770·4	10·2	8·1	75	N. 80° W.	4	6	Slight	b.	—
16	8 a.m.	50° 24′ N.	6° 5′ W.	10·20	35·25	28·32	—	—	10·7	8·4	73	S. 80° W.	5	8	Rough	c. g.	Station E. 6.
16	10.15 a.m.	50° 17′ N.	6° 3′ W.	10·38	35·35	28·41	—	—	—	—	—	—	—	—	—		—
16	Noon	50° 2′ N.	5° 7′ W.	10·47	35·41	28·46	30·21	767 3	10·8	9·0	79	S. 40° W.	6	10·5	Moderate	c.	—
16	1.30 p.m.	49° 53′ N.	5° 38′ W.	10 50	35·44	28·48	30·31	769·8	10·8	8·4	72	S. 55° W.	6	10·5	Moderate	c. g.	Station E. 7
18	2.10 p.m.	50° 14′ N.	3° 16′ W.	10 88	35·26	28·34	—	—	—	—	—	—	—	—	—	—	—
18	4 p.m.	50° 14′ N.	3° 0′ W.	11·18	35·16	28·25	—	—	—	—	—	—	—	—	—	—	—
18	7.55 p.m.	50° 20′ N.	2° 20′ W.	10·53	35·10	28·21	—	—	—	—	—	—	—	—	—	—	—
18	10.10 p.m.	50° 23′ N.	1° 50′ W.	10·30	35·14	28·24	—	—	—	—	—	—	—	—	—	—	—
18	Midnight	50° 25′ N.	1° 26′ W.	10·31	35·03	28·15	—	—	—	—	—	—	—	—	—	—	—
19	2 a.m.	50° 28′ N.	1° 5′ W.	10·52	34·72	27·90	—	—	—	—	—	—	—	—	—	—	—
19	4 a.m.	50° 26′ N.	0° 43′ W.	10·07	35·05	28·16	—	—	—	—	—	—	—	—	—	—	—
19	7.25 a.m.	50° 21′ N.	0° 19½′ W.	10·20	35·32	28·38	—	—	—	—	—	—	—	—	—	—	Station E. 21.
19	9 a.m.	50° 25′ N.	0° 5′ W.	10·48	35·32	28·38	—	—	—	—	—	—	—	—	—	—	—
19	10 a.m.	50° 28′ N.	0° 7′ E.	10·28	35·32	28·38	—	—	—	-	—	—	—	—	—	—	—
19	11 a.m.	50° 30′ N.	0° 15′ E.	10·31	35·25	28·32	—	—	—	—	—	—	—	—	—	—	—
19	0.50 p.m.	50° 33′ N.	0° 36′ E.	10·98	35·42	28·47	—	—	—	—	—	—	—	—	—	—	Station E. 22.
19	9.30 p.m.	51° 11′ N.	1° 37½′ E.	9·98	35·08	28·19	—	—	—	—	—	—	—	—		—	Station E 23.

SAMPLES and TEMPERATURES taken on DR. WOLFENDEN'S yacht *Silver Belle*.—Buchan Henry, Master, Observer.

Date.	Time.	Latitude.	Longitude.	Surface.			Barometer.		Air.			Wind.			Sea.	Sky.	—
				t.° C.	S.°/₀₀	σ_0	in.	m/m.	Dry Bulb.	Wet Bulb.	H.°/₀	Direction.	Force. B.	Force. m/s.			
May 31	5.45 p.m.	50° 40′ N.	0° 17′ W.	11·09	35·14	28·24	—	—	—	—	—	S. 50° W.	1		Smooth	b.	—
June 1	1.50 a.m.	50° 33′ N.	0° 05′ W.	11·05	35·32	28·38	—	—	—	—	—	N. 70° E.	1		Smooth	Clear.	—
1	7.30 a.m.	50° 26′ N.	0° 07′ E.	11·90	35·42	28·47	—	—	—	—	—	Nearly calm.			Smooth	b.	—
1	Noon	50° 26′ N.	0° 07′ E.	14·1	Very warm.							Dead calm.			Smooth	b.	—
1	8 p.m.	50° 23′ N.	0° 14′ E.	11·90	—	—	—	—	—	—	—	N. 45° W.	Variable		Smooth	b.	—
2	2 a.m.	50° 20′ N.	0° 20′ E.	11·9	35·42	28·47	—	—	—	—	—	N. 45° W.	Variable		Smooth	b.	—
2	5 a.m.	50° 13′ N.	0° 32′ E.	12·4	34·42	28·47	—	—	—	—	—	N. 30° E.	Fresh		—	b.	—
2	6.10 a.m.	50° 6′ N.	0° 49′ E.	13·1	33·62	27·02	—	—	—	—	—	N. 30° E.	Fresh		—	o.	—
2	7.50 a.m.	49° 58′ N.	0° 41′ E.	12·7	33·93	27·26	—	—	—	—	—	N. 30° E.	Strong		—	o.	—
2	8.45 a.m.	49° 59′ N.	0° 29′ E.	12·2	35·21	28·30	—	—	—	—	—	N. 30° E.	Strong		—	m.	—
2	10 a.m.	50° 0′ N.	0° 9′ E.	11·9	35·10	28·21	—	—	—	—	—	—	—		—	o.	—
2	11 a.m.	50° 1′ N.	0° 6′ W.	11·8	35·00	28·13	—	—	—	—	—	—	—		—	o.	—
2	0·30 p.m.	50° 1′ N.	0° 21′ W.	11·9	34·87	28·02	—	—	—	—	—	—	—		—	o.	—
2	1.30 p.m.	50° 2′ N.	0° 37′ W.	11·6	34·70	27·89	—	—	—	—	—	N. 5° E.	Fresh		—	—	—
2	3.15 p.m.	50° 3′ N.	0° 52′ W.	12·2	34·36	27·61	—	—	—	—	—	N. 5° E.	Light		—	—	—
2	5.30 p.m.	49° 49′ N.	1° 17′ W.	12·4	34·70	27·89	—	—	—	—	—	N. 5° E.	Light		—	—	—
2	8 p.m.	49° 52′ N.	1° 38′ W.	11·6	35·24	28·32	—	—	—	—	—	N. 30° E.	Light		—	—	—
2	10 p.m.	49° 55′ N.	1° 53′ W.	11·6	35·26	28·34	—	—	—	—	—	N. 30° E.	Light		—	—	—
2	11.45 p.m.	49° 57′ N.	2° 8′ W.	11·5	35·29	28·36	—	—	—	—	—	—	Fresh		Smooth	Clear	—
3	0.57 a.m.	49° 59′ N.	2° 24′ W.	11·2	35·40	28·45	—	—	—	—	—	—	Fresh		Smooth	Clear	—
3	2.13 a.m.	50° 3′ N.	2° 40′ W.	11·2	35·35	28·41	—	—	—	—	—	—	Fresh		Smooth	Clear	—
3	3.1 a.m.	50° 5′ N.	2° 54′ W.	11·2	35·35	28·41	—	—	—	—	—	—	Fresh		Smooth	Clear	—
3	4·3 a.m.	50° 7′ N.	3° 10′ W.	11·1	35·41	28·46	—	—	—	—	—	—	Fresh		Smooth	Clear	—
3	5.0 a.m.	50° 10′ N.	3° 23′ W.	11·3	35·23	28·31	—	—	—	—	—	N. 10° W.	Light		Smooth	Clear	—

AUGUST, 1903.—S.S. *Oithona*.

5	2 p.m.	50° 6′ N.	4° 6′ W.	14·89	35·38	28·44	30·21	767·3	15·7	13·3	77	S. 70° W.	3	4	Moderate	c. 4	—
5	4 p.m.	49° 53′ N.	3° 58′ W.	15·69	35·46	28·50	30·21	767·3	15·9	13·9	80	S. 70° W.	3	4	Moderate	c. 1	—
5	6 p.m.	49° 40′ N.	3° 51′ W.	15·37	35·46	28·50	30·22	767·6	15·9	14·4	85	S. 70° W.	2	2	Slight	b.	—
5	8 p.m.	49° 27′ N.	3° 46′ W.	15·22	35·44	28·48	30·16	766·1	15·5	13·8	83	S. 70° W.	2	2	Swell	b.	—
5	11 p.m.	49° 16′ N.	3° 37′ W.	15·13	35·48	28·51	30·30	769·6	15·5	13·8	83	S. 75° W.	3	4	Heavy swell	b.	Station E. 8.
6	2 a.m.	49° 24′ N.	3° 25′ W.	15·23	—	—	30·30	769·6	15·0	13·6	86	N. 40° W.	2	2	Swell	b.	—
6	4.10 a.m.	49° 35′ N.	3° 13′ W.	14·90	—	—	30·29	769·3	14·7	12·3	76	N. 40° W.	2	2	Moderate	b.	—
6	6 a.m.	49° 39′ N.	3° 9′ W.	14·51	35·43	28·47	30·30	769·6	14·4	13·6	92	N. 85° W.	3	4	Smooth	b.	Station E. 9.
6	8 a.m.	49° 41′ N.	3° 1′ W.	14·55	—	—	30·32	770·1	14·6	13·5	89	N 40° W.	2	2	Swell	c. 1	—
6	Noon	49° 49′ N.	2° 33′ W.	15·05	35·35	28·41	30·30	769·6	14·8	13·1	83	N. 85° W.	3	4	Smooth	c.	Station E. 10.
6	2 p.m.	49° 53′ N.	2° 28′ W.	14·81	—	—	30·33	770·4	15·4	13·4	80	N. 40° W.	1	1	Slight	c. 1	—
6	4 p.m.	49° 58′ N.	2° 14′ W.	15·07	—	—	30·30	769·6	15·0	13·2	82	N. 60° W.	1	1	Slight	c.	—
6	6.50 p.m.	50° 5′ N.	1° 58′ W.	14·89	35·26	28·34	30·25	768·3	14·9	13·7	88	W.	3	4	Slight	c.	Station E. 11.
6	10 p.m.	49° 59′ N.	1° 33′ W.	15·07	—	—	30·27	768·8	14·9	13·4	85	S. 60° W.	1	1	Smooth	b.	—
7	1.30 a.m.	49° 55′ N.	1° 9′ W.	15·48	34·97	28·11	30·24	768·1	15·0	13·8	88	N. 85° W.	2	2	Smooth	c.	Station E. 12.
7	4 a.m.	50° 4′ N.	1° 11′ W.	14·79	35·19	28·28	30·22	767·6	14·8	12·8	80	N.	2	2	Smooth	c. 3	—
7	7.15 a.m.	50° 20′ N.	1° 15′ W.	15·58	35·17	28·27	30·22	767·6	15·0	13·1	81	N. 85° E.	1	1	Smooth	c.	Station E. 13.
7	10 a.m.	50° 29′ N.	1° 16′ W.	16·82	34·88	28·03	30·20	767·1	15·2	12·8	76	N. 80° E.	0-1	1	Smooth	c. 1	—
7	1 p.m.	50° 33′ N.	1° 17′ W.	16·67	34·89	28·04	30·20	767·1	15·4	12·4	71	N. 75° E.	0-1	1	Smooth	b.	Station E. 14.
7	4 p.m.	50° 30′ N.	0° 55′ W.	17·37	34·97	28·11	30·17	766·3	16·8	12·6	62	S. 85° E.	1	1	Smooth	b.	—
7	6 p.m.	50° 33′ N.	0° 37′ W.	16·10	35·09	28·20	30·15	765·8	16·8	13·2	74	N. 50° E.	2	2	Smooth	b.	—
7	8 p.m.	50° 32′ N.	0° 8′ W.	15·92	35·16	28·25	30·12	765·0	16·2	13·6	75	N. 50° E.	2	2	Smooth	b.	—

August, 1903.—S.S. *Oithona—continued.*

Date.	Time.	Latitude.	Longitude.	Surface.			Barometer,		Air.			Wind.			Sea.	Sky.	—
				t.° C.	S.°/₀₀	σ_0	in.	m/m.	Dry Bulb.	Wet Bulb.	H.°/₀	Direction.	Force. B.	Force. m/s.			
8	0.45 a.m.	50° 34′ N.	0° 36′ E.	15·32	35·20	28·29	30·10	764·5	15·8	14·5	87	S. 85° E.	2	2	Smooth	b. c.	Station E. 22.
8	4 a.m.	50° 30′ N,	0° 21′ E.	15·32	35·23	28·31	30·00	762·0	15·8	14·2	84	S, 60° E.	2	2	Smooth	b. c.	—
8	6 a.m.	50° 25′ N.	0° 2′ E.	15·22	35·23	28·31	29·98	761·5	15·6	14·3	87	S. 60° E.	1	1	Smooth	b.	—
8	8 a.m.	50° 21′ N.	0° 20′ W.	15·38	35·21	28·31	29·91	759·7	16·0	14·3	83	S. 60° E.	3	4	Slight	b. c.	Station E.
8	Noon	50° 22′ N.	0° 33′ W.	15·82	35·14	28·24	29·85	758·2	16·5	14·7	83	S. 85° E.	—	—	Smooth	b.	—
8	2 p.m.	50° 22′ N.	0° 52′ W.	16·52	35·15	28·25	29·80	756·9	17·3	15·7	85	S. 20° E.	2	2	Slight	b. c.	—
8	4 p.m.	50° 24′ N.	1° 22′ W.	16·37	—	—	29·80	756·9	17·0	15·5	86	S. 30° W.	2	2	Slight	b. c.	—
8	6 p.m	50° 26′ N.	1° 43′ W.	16·07	—	—	29·76	755·9	16·6	15·6	90	S. 50° W.	3	4	Slight	c.	—
8	7 p.m.	50° 27′ N.	1° 50′ w.	15·99	35·24	28·32	29·87	758·7	16·1	15·5	95	S. 50° W.	4	6	Moderate	c.	Station E. 15.
8	10 p.m.	50° 25′ N.	2° 4′ W.	15·77	—	—	29·83	757·7	15·8	15·0	92	S. 45° W.	6	10·5	Rough	c. 3	—
8	Midnight	50° 24′ N.	2° 20′ W.	15·67	—	—	29·86	758·4	15·8	14·6	88	S. 70° W.	5	8	Rough	c.	—
9	2.30 a.m.	50° 23′ N.	2° 28′ W.	15·83	35·25	28·32	29·80	756·9	15·8	14·0	82	S. 50° W.	6	10·5	Rough	Clear	Station E. 16.
10	2 p.m.	50° 24′ N.	3° 28′ W.	15·12	35·28	28·35	29·87	758·7	16·4	12·8	66	S. 45° W.	4	6	Slight	c. 9	—
10	4.40 p,m.	50° 23′ N.	3° 8′ W.	15·59	35·32	28·38	29·87	758·7	15·5	13·9	84	S. 75° W.	6-7	13	Rough	c.	Station E. 18.
12	10 a.m.	50° 11′ N.	2° 52′ W.	14·77	35·35	28·41	29·96	761·0	14·5	13·0	85	S. 50° W.	3	4	Smooth	c. k.	Station E. 17.
12	3.25 p.m.	49° 56′ N.	3° 23′ W.	14·98	35·36	28·42	29·97	761·2	15·0	13·8	88	S. 40° W.	—	—	Smooth	o.	Station E. 19.
12	10 p.m.	50° 8′ N.	3° 47′ W.	14·37	35·35	28·41	29·96	761·0	14·3	13·7	94	—	Calm.		Smooth	Clear	Station E. 20.
No work could be done from August 12th to August 25th owing to the weather.																	
26	3.40 a.m.	50° 2′ N.	4° 22′ W.	14·25	35·32	28·38	30·1	764·0	13·9	12·8	88	N. 60° W.	—	—	Smooth	Clear	Station E. 1.
26	6 a.m.	49° 53′ N.	4° 26′ W.	14·50	35·41	28·46	30·1	764·0	14·7	14·4	97	S. 75° W.	1	1	Smooth	b.	—
26	8.10 a.m.	49° 40′ N.	4° 32′ W.	15·17	35·44	28·48	30·2	767·0	15·2	14·2	90	S. 75° W.	1	1	Slight swell	Hazy	—
26	11.30 a.m.	49° 27′ N.	4° 42′ W.	14·82	35·46	28·50	30·22	767·6	14·7	13·9	92	S. 35° W.	4	6	Moderate	o.	Station E. 2.
28	1 p.m.	49° 53′ N.	5° 38′ W.	14·67	35·37	28·43	30·13	765·3	15·5	14·2	87	S. 5° E.	5	8	Moderate	o. g.	Station E. 7.
28	4.2 p.m.	49° 54′ N.	5° 25′ W.	13·58	35·44	28·48	—	—	15·0	14·8	98	S. 5° E.	2	2	Moderate	o. d.	—

September, 1903.—S.S. *Triton.*

1	8 a.m.	49° 53′ N.	5° 5′ W.	14·15	35·39	28·44	30·0	762·0	14·7	13·8	91	S. 65° W.	2	2	Smooth	c.	—
1	10.15 a.m.	49° 31′ N.	5° 10′ W.	15·47	35·43	28·47	30·0	762·0	15·8	14·3	85	S. 75° W.	2	2	Smooth	c.	—
1	0.15 p.m.	49° 12′ N.	5° 14′ W.	14·52	35·41	28·46	30·0	762·0	15·2	14·4	92	S. 75° W.	1	1	Smooth	o.	—
1	5.10 p.m.	48° 34′ N.	5° 13′ W.	15·72	35·31	28·38	30·21	767·3	15·2	14·6	94	—	Calm		Smooth	o. d.	Station E. 3.
1	7.30 p.m.	48° 30′ N.	5° 38′ W.	16·32	35·26	28·34	—	—	16·1	15·2	91	N. 75° E.	1	1	Smooth	o. d.	—
2	1.30 a.m.	48° 27′ N.	6° 35′ W.	16·49	35·25	28·32	30·0	762·0	16·1	15·7	97	N. 30° E.	4	6	Smooth	c. 2	Station E. 4.
2	5 a.m.	48° 50′ N.	6° 36′ W.	16·32	35·23	28·31	—	—	15·8	14·6	88	N. 30° E.	3	4	Smooth	o. r.	—
2	8.20 a.m.	49° 6′ N.	6° 32′ W.	16·05	35·14	28·24	29·9	759·0	14·7	14·1	94	N. 30° E.	6	10·5	Moderate	c. d.	Station E. 5.

November, 1903.—S.S. *Huxley.*

3	9.48 a.m.	50° 2′ N.	4° 22′ W.	13·11	35·34	28·40	30·30	769·6	11·3	9·4	78	N. 30° E.	3	4	Slight	b.	Station E. 1.
3	11.25 a.m.	49° 57′ N.	4° 27′ W.	13·20	35·35	28·41	—	—	—	—	—	—	—	—	—	—	—
3	Noon	49° 52′ N.	4° 29′ W.	13·22	35·35	28·41	30·33	770·4	12·1	10·0	78	N. 5° E.	1	1	Smooth	b.	—
3	1 p.m.	49° 47′ N.	4° 34′ W.	13·29	35 36	28·42	—	—	—	—	—	—	—	—	—	—	—
3	2 p.m.	49° 39′ N.	4° 41′ W.	13·38	35 37	28·43	30·32	770·1	12·4	9·8	72	N. 15° E.	2	2	Slight, some swell.	c.	—
3	4.45 p.m.	49° 27′ N.	4° 42′ W.	13·11	35 34	28·40	30·25	768·3	12·4	10·0	74	N. 15° E.	4	6	Moderate	c.	Station E. 2.
3	8 p.m.	49° 9′ N.	4° 55′ W.	12·98	35 34	28·40	30·35	770·9	12·1	9·1	68	N. 30° E.	3	4	Moderate	c.	—
3	10.30 p m.	48° 48′ N.	5° 19′ W.	12·93	35 35	28·41	30·35	770·9	12·1	10·1	78	N. 15° W.	5	8	Slight	c.	—
4	12.15 a.m.	48° 42′ N.	5° 41′ W.	12·77	35 42	28·47	30.29	769·4	12·1	9·9	78	N. 75° E.	5	8	Increasing	c.	—
4	6 a.m.	48° 34′ N.	5° 13′ W.	13·33	35·46	28·50	—	—	—	—	—	N. 15° W.	6	10·5	Rough	c.	Station E 3.
4	8 a.m.	48° 32′ N.	5° 40′ W.	—	35·40	28·45	—	—	—	—	—	—	—	—	—	—	—
4	10.10 a.m.	48° 28′ N.	6° 24′ W.	2·85	35·39	28·44	30·33	770·4	—	—	—	N. 30° E.	7	13	Rough	o.	—
4	6 p.m.	48° 27′ N.	6° 35′ W.	2·83	35·41	28·46	30·33	770·4	—	—	—	N. 30° E.	7	13	Very rough	o.	Station E. 4.
4	—	48° 39′ N	6° 35′ W.	—	35·39	28·44	—	—	—	—	—	—	—	—	—	—	—

NOVEMBER, 1903.—S.S. *Huxley—continued.*

Date.	Time.	Latitude.	Longitude.	Surface.			Barometer.		Air.			Wind.			Sea.	Sky.	——
				t.° C.	S.°/₀₀	σ_0	in.	m/m.	Dry Bulb.	Wet Bulb.	H.°/₀	Direction.	Force. B.	Force. m/s.			
5	—	48° 51′ N.	6° 34′ W.	—	35·26	28·34	—	—	—	—	—	—	—	—	—	—	—
5	10.50 a.m.	49° 6′ N.	6° 32′ W.	12·29	35·22	28·31	30·43	772·9	12·2	10·5	81	N. 50° E.	6	10·5	Rough	b. hazy	Station E. 5.
5	1 p.m.	49° 18′ N.	6° 30′ W.	11·93	35·24	28·32	—	—	—	—	—	N. 50° E.	7	13	Rough	o.	—
5	3.25 p.m.	49° 35′ N.	6° 13′ W.	11·78	35·25	28·32	—	—	—	—	—	N. 75° E.	7	13	Rough	c. 9	—
6	Attempted Station E. 6, but found the sea too rough; put into St. Ives' Bay.																
7	7.30 a.m.	50° 15′ N.	5° 27′ W.	12·17	35·21	28·30	—	—	—	—	—	S. 85° E.	3	4	Smooth	c.	—
7	8.55 a.m.	50° 19′ N.	5° 44′ W.	12·51	35·28	28·35	30·37	771·8	—	—	—	—	—	—	Smooth	c.	—
7	11.20 a.m.	50° 24′ N.	6° 5′ W.	12·48	35·24	28·32	30·32	770·1	11·8	9·7	76	S. 60° E.	4	6	Slight	c. 5	Station E. 6.
7	2 p.m.	50° 18′ N.	6° 3′ W.	12·62	35·24	28·32	30·28	769·1	12·3	9·7	72	N. 85° E.	4	6	Moderate	o.	—
7	3.20 p.m.	50° 10′ N.	5° 55′ W.	12·52	35·28	28·35	—	—	—	—	—	—	—	—	—	—	—
7	4.10 p.m.	50° 6½′ N.	5° 52′ W.	12·47	35·33	28·39	30·36	771·1	11·6	10·0	82	N. 75° E.	4	6	Slight	c. 6.	—
7	5.5 p.m.	50° 3′ N.	5° 46′ W.	12·50	35·30	28·37	—	—	—	—	—	—	—	—	—	—	—
7	8.25 p.m.	49° 53′ N.	5° 38′ W.	12·33	35·34	28·40	30·26	768·6	11·9	10·3	82	S. 60° E.	4	6	Slight	Clear	Station E. 7.
7	—	49° 45½′ N.	5° 10½′ W.	—	35·28	28·35	—	—	—	—	—	—	—	—	—	—	—
8	—	50° 8½′ N.	4° 37½′ W.	—	35·08	28·19	—	—	—	—	—	—	—	—	—	—	—
9	7 p.m.	50° 4′ N.	4° 0′ W.	12·97	35·35	28·41	30·36	771·1	11·7	8·3	63	N. 60° W.	3	4	Slight	c.	Some phosphorescence.
9	8.30 p.m.	49° 50′ N.	3° 53′ W.	13·17	35·41	28·46	30·18	766·6	—	—	—	—	—	—	Slight	o.	—
9	9.25 p.m.	49° 42′ N.	3° 48′ W.	13·29	35·44	28·48	30·18	766·6	12·1	8·8	63	N. 60° W.	3	4	Slight	c. 9	—
9	10.45 p.m.	49° 31′ N.	3° 44′ W.	13·41	35·44	28·48	30·18	766·6	—	—	—	—	—	—	—	—	—
10	3 a.m.	49° 16′ N.	3° 37′ W.	13·20	35·43	28·47	30·23	767·8	11·9	10·0	79	—	5	8	Some swell	Clear	Station E. 8.
10	5.44 a.m.	49° 7′ N.	3° 33′ W.	13·38	35·37	28·43	30·25	768·3	12·2	10·3	79	N. 40° W.	3	4	Smooth	o.	—
10	8 a.m.	49° 26′ N.	3° 18′ W.	13·57	—	—	30·26	768·6	—	—	—	N. 60° W.	3	4	Slight	c. 5	—
10	11.20 a.m.	49° 39′ N.	3° 9′ W.	13·53	35·44	28·48	30·25	768·3	12·4	10·2	76	N. 85° W.	4	6	Moderate.	c. 8	Station E
10	5.45 p.m.	49° 49′ N.	2° 33′ W.	13·63	35·44	28·48	30·22	767·6	12·6	11·0	82	N. 85° W.	4	6	Heavy swell.	o.	Station E. 10.
11	9 a.m.	50° 5′ N.	1° 58′ W.	13·44	35·43	28·47	30·34	770·6	11·9	10·2	81	N. 50° W.	2	2	Slight	o	Station E. 11.
11	2.35 p.m.	50° 3′ N.	1° 11′ W.	13·57	—	—	30·32	767·8	12·1	10·6	83	N. 30° W.	2	2	Smooth	o.	—
11	4.45 p.m.	50° 1′ N.	0° 40′ W.	13·59	—	—	30·34	770·6	12·1	10·7	84	N. 30° W.	2	2	Smooth	o. d.	—
11	7.10 p.m.	50° 0′ N.	0° 21′ W.	13·57	35·35	28·41	30·35	770·9	12·0	10·9	87	N. 75° W.	3	4	Smooth	r. d. o.	Station E. 24.
11	9.50 p.m.	49° 56′ N.	0° 34′ W.	13·47	35·39	28·44	—	—	—	—	—	—	—	—	—	—	—
11	10.43 p.m.	49° 54′ N.	0° 40′ W.	13·50	35·35	28·41	—	—	—	—	—	—	—	—	—	—	—
11	11.30 p.m.	49° 53′ N.	0° 50′ W.	13·62	35·34	28·40	—	—	—	—	—	—	—	—	—	—	—
12	12.30 a.m.	49° 51′ N.	1° 0′ W.	13·47	35·26	28·34	—	—	—	—	—	—	—	—	—	—	—
12	2.50 a.m.	49° 48′ N.	1° 13′ W.	12·97	34·94	28·08	30·35	770·9	12·5	9·8	71	N. 70° W.	1	1	Smooth	c.	Station E. 12a.
12	5.30 a.m.	49° 55′ N.	1° 9′ W	13·37	34·93	28·07	30·32	770·1	12·5	10·4	77	N. 75° W,	1	1	Smooth	c. 8.	Station E. 12.
12	7.36 a.m.	50° 6′ N.	1° 9′ W.	13·68	35·36	28·42	—	—	—	—	—	N. 40° W.	3	4	Smooth	o.	—
12	8.50 a.m.	50° 17′ N.	1° 14′ W.	13·12	35·28	28·35	30·32	770·1	—	—	—	—	—	—	—	—	—
12	10.9 a.m.	50° 20′ N.	1° 15′ W.	13·18	35·29	28·36	30·31	769·9	12·2	11·5	92	S. 75° W.	3	4	Slight	o. p.	Station E. 13.
12	11.45 a.m.	50° 26′ N.	1° 17′ W.	12·61	35·12	28·22	—	—	—	—	—	—	—	—	—	—	—
12	2 p.m.	50° 33′ N.	1° 17′ W.	12·15	34·77	27·94	30·25	768·3	12·0	10·8	86	S. 75° W.	4	6	Moderate	o.	Station E. 14.
12	7.20 p.m.	50° 27′ N.	1° 50′ W.	12·57	35·14	28·24	30·25	768·3	12·4	11·1	85	S. 75° W.	4	6	Moderate	c. 5	Station E. 15.
13	12.30 a.m.	50° 23′ N.	2° 28′ W.	12·47	35·12	28·22	30·25	768·3	12·3	11·0	85	S. 75° W.	2	2	Slight	o.	Station E. 16.
13	3.30 a.m.	50° 18′ N.	2° 38′ W.	12·48	35·37	28·43	—	—	—	—	—	—	—	—	—	—	—
13	6.15 a.m.	50° 11′ N.	2° 52′ W.	13·06	35·39	28·44	30·22	767·6	12·5	10·8	81	S. 50° W.	2	2	Smooth	o.	Station E. 17.
13	10.30 a.m.	50° 23′ N.	3° 8′ W.	12·88	35·32	28·38	30·18	766·6	12·1	10·6	83	S. 15° W.	2	2	Smooth	o.	Station E. 18.
13	5 p.m.	49° 56′ N.	3° 23′ W.	12·93	35·44	28·48	30·03	762·7	11·6	9·8	79	S. 5° W.	4	6	Moderate	o.	Station E. 19.
13	9.30 p.m.	50° 8′ N.	3° 47′ W.	12·84	35·29	28·36	29·91	759·7	12·8	11·4	84	S. 5° W.	5	8	Heavy swell.	o.	Station E. 20.
16	5.30 p.m.	50° 18′ N.	3° 37′ W.	12·07	35·12	28·22	—	—	—	—	—	—	—	—	—	—	—
18	11.0 p.m.	50° 21′ N.	0° 19′ W.	12·47	35·43	28·47	—	—	—	—	—	N. 30° E.	5	8	Moderate	Clear	Station E. 21.
19	—	50° 20′ N.	0° 4½′ W.	—	35·47	28·51	—	—	—	—	—	—	—	—	—	—	—
19	—	50° 17′ N.	0° 20′ E.	—	35·47	28·51	—	—	—	—	—	—	—	—	—	—	—
19	—	50° 20′ N.	0° 26′ E.	—	35·46	28·50	—	—	—	—	—	—	—	—	—	—	—
19	—	50° 26′ N.	0° 34′ E.	—	35·43	28·47	—	—	—	—	—	—	—	—	—	—	—
19	6.40 a.m.	50° 33′ N.	0° 36′ E.	12·43	—	—	30·00	762·0	7·6	5·61	74	N. 50° E.	4	6	Moderate	c. 5	Station E. 22.

TABLE 5.

November Hydrographic Cruise, 1903.

Surface Samples and Temperatures taken by Officers of Steamers in the ENGLISH CHANNEL, ST. GEORGE'S CHANNEL, *and* BAY OF BISCAY.

Date.	Time.	Latitude.	Longitude.	t.° C.	S.°/₀₀.	σ_0.	—
S.S. "CALVADOS."—Newhaven to Caen. **Observations and Samples taken by Captain Banks.**							
18th November..	11.45 p.m.	50° 35′ N.	0° 2′ E.	12·2°	35·30	28·37	
19th November..	2.5 a.m.	50° 11′ N.	0° 03′ W.	12·6°	35·47	28·51	
19th November..	3.20 a.m.	49° 59′ N.	0° 06′ W.	12·2°	35·40	28·45	
19th November..	4.35 a.m.	49° 47′ N.	0° 08′ W.	12·1°	34·99	28·12	
Five samples were taken, but one was broken in transit.							
S.S. "XENIA."—Plymouth to Cork. **Observations and Samples taken by Captain F. Ridge.**							
7th November..	2.55 p.m.	50° 15′ N.	6° 0′ W.	12·5°	35·24	28·32	
7th November..	4.30 p.m.	50° 29′ N.	6° 23′ W.	12·2°	35·25	28·32	
7th November..	6.5 p.m.	50° 43′ N.	6° 44′ W.	11·8°	35·17	28·27	
7th November..	7.50 p.m.	50° 59′ N.	7° 5′ W.	12·2°	35·19	28·28	
7th November..	9.35 p.m.	51° 14′ N.	7° 27′ W.	12·1°	35·19	28·28	
7th November..	11.5 p.m.	51° 28′ N.	7° 48′ W.	11·9°	35·16	28·25	
S.S. "LOANDA."—Liverpool to Teneriffe. **Observations and Samples taken by Captain G. G. Hough.**							
20th November..	6.0 p.m.	46° 32′ N.	9° 5′ W.	14·4°	35·71	28·70	Air 12·2° C.; wind N.N.W. moderate; sea smooth.
21st November..	3.0 a.m.	45° 0′ N.	9° 50′ W.	14·4°	35·62	28·63	Air 12·2° C.; wind N. moderate; sea smooth.
21st November..	10.0 a.m.	44° 2′ N.	10° 18′ W.	15·0°	35·68	28·67	Air 13·9° C.; wind N.E. moderate.
21st November..	4.0 p.m.	42° 55′ N.	10° 48′ W.	15·6°	35·81	28·78	Air 15·0° C.; wind N.N.E. strong breeze.
Two samples were broken in transit.							
S.S. "EASTFIELD."—Cardiff to Constantinople. **Observations and Samples taken by Mr. F. B. Allen, chief engineer.**							
9th November..	1.0 p.m.	48° 0′ N.	7° 0′ W.	13·4°	Sample broken.		Wind S.; light breeze; sea smooth.
9th November..	8.0 p.m.	46° 0′ N.	8° 0′ W.	14·7°	35·44	28·48	Light W. wind; westerly swell.
10th November..	1.0 p.m.	44° 0′ N.	9° 30′ W.	15·8°	35·79	28·76	Light S.E. wind; heavy westerly swell.
11th November..	4.0 a.m.	42° 0′ N.	9° 20′ W.	17·2°	35·93	28·88	Light E. wind; long northerly swell.
11th November..	6.30 p.m.	40° 0′ N.	9° 30′ W.	18·9°	36·02	28·95	Light E. wind; northerly swell.
12th November..	8.30 a.m.	38° 0′ N.	9° 30′ W.	16·7°	36·06	28·98	Light E. wind; smooth sea.
Mr. Allen remarks:—"I have noticed that the water between 41° N. and 39° N., off Cape Roca and Lisbon, is always 2° or 3° F. warmer than anywhere else on the Portuguese coast on several previous voyages."							
S.S. "HELGA."—Department of Agriculture and Technical Instruction for Ireland. **Observations and Samples taken by Mr. G. P. Farran, Naturalist.**							
8th November..	11.0 a.m.	50° 19′ N.	10° 17′ W.	12·5° C.	35·51	28·54	Sea smooth; slight swell; wind S.E. 3–4.
8th November..	12.6 p.m.	50° 27′ N.	10° 11′ W.	12·4° C.	35·44	28·48	
8th November..	2.55 p.m.	50° 46′ N.	10° 0′ W.	12·0° C.	35·44	28·48	
8th November..	4.30 p.m.	50° 55′ N.	9° 54′ W.	11·9° C.	35·35	28·41	Wind 2–3; moderate swell.
8th November..	5.20 p.m.	51° 5′ N.	9° 48′ W.	11·45° C.	35·17	28·27	
8th November..	6.45 p.m.	51° 14′ N.	9° 42′ W.	11·2° C.	35·12	28·22	
8th November..	7.35 p.m.	51° 24½′ N.	9° 36½′ W.	10·95° C.	35·08	28·19	
9th November..	2.30 p.m.	51° 41′ N.	10° 10′ W.	10·85° C.	34·78	28·95	Wind 5–6; heavy swell.
9th November..	9.0 p.m.	51° 56′ N.	10° 19′ W.	10·8° C.	34·64	28·84	Position given as "Valentia Harbour."

The temperatures on this page were all taken to ¼° F., except those taken on the s.s. "Helga," which may be considered as accurate.

TABLE 6 contains the observations of temperature and salinity at various depths on the Stations. The Stations are arranged in order from East to West, and the observations for each during the four cruises are given side by side for purposes of comparison. The columns for each month show the depth in metres and fathoms, the temperature, salinity, σ_o, and σ_t. σ_o is $(1-S_o)\,1000$, where S_o is the specific gravity at 0° C. referred to distilled water at 4° C. σ_t is the specific gravity corrected to the temperature *in situ* by Knudsen's Tables, but *not* corrected for compression, the formula for this being hardly well enough known.

TABLE 6.

STATION E. 22.

50° 34′ N. Latitude. 0° 36½′ E. Longitude.

February, 1903.						19th May, 1903.						8th August, 1903.						November, 1903.					
M.	F.	t.°	S.°/₀₀	σ_o	σ_t	M.	F	t.°	S.°/₀₀	σ_o	σ_t	M.	F.	t.°	S.°/₀₀	σ_o	σ_t	M.	F.	t.°	S.°/₀₀	σ_o	σ_t
—	—	—	—	—	—	0	0	10·98	35·42	28·47	27·13	0	0	15·32	35·20	28·29	26 08	0	0	12·43	Sample lost.		
—	—	—	—	—	—	5	2·7	10·60	—	—	—	5	2·7	15·23	35·17	28·27	26·08	5	2·7	12·56	35·36	28·42	26·81
—	—	—	—	—	—	10	5·5	10·11	—	—	—	10	5·4	15·23	35·17	28·27	26·08	10	5·4	12·57	35·39	28·44	26·83
—	—	—	—	—	—	15	8·2	10·09	—	—	—	15	8·2	15·23	35·17	28·27	26·08	20	10·9	12·58	35·39	28·44	26·83
—	—	—	—	—	—	20	10·9	10·07	35·37	28·43	27·25	20	10·9	15·22	35·16	28·25	26·06	41	22·4	12·57	35·36	28·42	26·81
—	—	—	—	—	—	30	16·4	10·06	—	—	—	30	16·4	15·22	35·17	28·27	26·08	Bottom: 44 metres = 24·0 fathoms. Gravel.					
—	—	—	—	—	—	40	21·8	10·05	—	—	—	38	20·8	15·22	35·16	28·25	26·06						
—	—	—	—	—	—	54	29·5	10·05	35·37	28·43	27·26	Bottom: 41 metres = 22·4 fathoms. Gravel and shell.											
Bottom: 57 metres = 31·1 fathoms. Gravel and shell.																							

STATION E. 21.

50° 21′ N. Latitude. 0° 19½′ W. Longitude.

February, 1903.						19th May, 1903.						8th August, 1903.						18th November, 1903.					
—	—	—	—	—	—	0	0	10·20	35·32	28·38	27·18	0	0	15·38	35·21	28·30	26·07	0	0	12·47	35·43	28·47	26·86
—	—	—	—	—	—	5	2·7	10·18	—	—	—	5	2·7	15·20	35·17	28·27	26·08	5	2·7	12·63	35·41	28·46	26·81
—	—	—	—	—	—	10	5·4	10·14	—	—	—	10	5·4	15·20	35·19	28·28	26·09	15	8·2	12·64	35·40	28·45	26·80
—	—	—	—	—	—	15	8·2	10·12	—	—	—	15	8·2	15·18	35·19	28·28	26·10	30	16·4	12·64	35·40	28·45	26·80
—	—	—	—	—	—	20	10·9	10·10	35·32	28·38	27·20	20	10·9	15·18	35·19	28·28	26·10	47	25·7	12·65	35·40	28·45	26·80
—	—	—	—	—	—	30	16·4	10·10	—	—	—	30	16·4	15·17	35·18	28·28	26·10	Bottom: 50 metres = 27·3 fathoms. Gravel.					
—	—	—	—	—	—	40	21·8	10·10	—	—	—	40	21·8	15·16	35·19	28·28	26·10						
—	—	—	—	—	—	55	30·0	10·10	35·32	28·38	27·20	48	26·2	15·18	35·22	28·31	26·12						
Bottom: 59 metres = 32·2 fathoms. Stones.						Bottom: 50 metres = 27·3 fathoms. Hard.																	

STATION E. 24.

50° 0′ N. Latitude. 0° 21′ W. Longitude.

February, 1903.						May, 1903.						August, 1903.						11th November, 1903.					
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0	0	13·57	35·35	28·41	26·57
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5	2·7	13·63	35·34	28·40	26·54
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	10	5·4	13·63	35·34	28·40	26·54
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	15	8·2	13·63	35·34	28·40	26·54
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	20	10·9	13·63	35·34	28·40	26·54
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	30	16·4	13·63	35·34	28·40	26·54
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	40	21·8	13·63	35·35	28·41	26·55
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	56	30·6	13·64	35·34	28·40	26·54
																		Bottom: 58 metres = 31·7 fathoms. Stones and gravel.					

TABLE 6—*continued.*

STATION E. 12.

49° 55′ N. Latitude. 1° 9′ W. Longitude.

M.	F.	t.°	S.°/₀₀	σ_0	σ_t
12th February, 1903.					
0	0	8·87	35·28	28·35	27·37
5	2·7	8·75	35·26	28·34	27·38
10	5·4	8·75	35·26	28·34	27·38
15	8·2	8·75	35·26	28·34	27·38
20	10·9	8·75	35·26	28·34	27·38
30	16·4	8·78	35·26	28·34	27·38
40	21·8	8·85	35·29	28·36	27·39
50	27·3	8·85	35·31	28·38	27·40
58	31·7	8·85	35·31	28·38	27·40
Bottom: 60 metres = 32·8 fathoms. Hard, with sand and shell.					
8th May, 1903.					
0	0	9·84	34·94	28·08	26·96
5	2·7	9·74	34·94	28·08	26·97
10	5·4	9·73	34·94	28·08	26·97
15	8·2	9·72	34·92	28·06	26·95
20	10·9	9·74	34·92	28·06	26·95
30	16·4	9·73	34·94	28·08	26·97
40	21·8	9·72	34·94	28·08	26·97
55	30·0	9·72	34·94	28·08	26·97
Bottom: 57½ metres = 31·4 fathoms. Gravel.					
7th August, 1903.					
0	0	15·48	34·97	28·11	25·88
5	2·7	15·40	34·95	28·09	25·87
10	5·4	15·38	34·96	28·09	25·87
15	8·2	15·38	34·96	28·09	25·87
20	10·9	15·40	34·95	28·09	25·87
30	16·4	15·40	34·95	28·09	25·87
40	21·8	15·40	34·96	28·09	25·87
50	27·3	15·40	34·96	28·09	25·87
63	34·4	15·40	34·94	28·08	25·86
Bottom: 63 metres = 34·4 fathoms. Hard: "Coral" (fishermen).					
12th November, 1903.					
0	0	13·37	34·93	28·07	26·28
5	2·7	13·39	34·94	28·08	26·29
10	5·4	13·39	34·93	28·07	26·28
15	8·2	13·39	34·94	28·08	26·29
20	10·9	13·39	34·92	28·06	26·27
30	16·4	13·39	34·92	28·06	26·27
40	21·8	13·39	34·92	28·06	26·27
60	32·8	13·38	34·92	28·06	26·27
Bottom: 63 metres = 34·4 fathoms. Rock and gravel. The stopper of the surface sample bottle did not fit perfectly.					

STATION E. 13.

50° 20′ N. Latitude. 1° 15′ W. Longitude.

12th February, 1903.					
0	3	7·48	35·23	28·31	27·55
5	2·7	7·46	35·21	28·30	27·54
10	5·4	7·46	35·22	28·31	27·55
15	8·2	7·46	35·23	28·31	27·55
20	10·9	7·46	35·23	28·31	27·55
30	16·4	7·48	35·24	28·32	27·56
35	19·1	7·48	35·23	28·31	27·55
Bottom: 36 metres = 19·7 fathoms.					
6th May, 1903.					
0	0	9·48	35·07	28·18	27·11
5	2·7	9·38	35·04	28·16	27·11
10	5·4	9·33	35·05	28·16	27·12
15	8·2	9·32	35·05	28·16	27·12
20	10·9	9·32	35·05	28·16	27·12
30	16·4	9·32	35·05	28·16	27·12
40	21·8	9·32	35·05	28·16	27·12
51	27·9	9·33	35·05	28·16	27·12
Bottom uneven: 53 metres=29 fathoms. Stones covered with Polyzoa.					
7th August, 1903.					
0	0	15·58	35·17	28·27	26·00
5	2·7	15·42	35·16	28·25	26·01
10	5·4	15·42	35·14	28·24	26·00
15	8·2	15·42	35·14	28·24	26·00
20	10·9	15·42	35·17	28·27	26·03
30	16·4	15·41	Sample lost.		
40	21·8	15·41	35·14	28·24	26·00
49	26·8	15·41	35·17	28·27	26·03
Bottom: 53 metres = 29 fathoms. Hard, with some shell and gravel.					
12th November, 1903.					
0	0	13·18	35·29	28·36	26·60
5	2·7	13·21	35·27	28·35	26·57
10	5·4	13·22	35·28	28·35	26·58
15	8·2	13·22	35·27	28·35	26·57
20	10·9	13·22	35·27	28·35	26·57
30	16·4	13·22	35·27	28·35	26·57
40	21·8	13·22	35·27	28·35	26·57
50	27·3	13·23	35·26	28·34	26·57
Bottom: 52 metres = 28·4 fathoms. Black and white sand.					

STATION E. 14.

50° 33′ N. Latitude. 1° 17′ W. Longitude.

12th February, 1903.					
0	0	7·67	35·23	28·31	27·52
5	2·7	7·66	35·22	28·31	27·52
10	5·4	7·66	35·23	28·31	27·52
15	8·2	7·66	35·22	28·31	27·52
20	10·9	7·66	35·23	28·31	27·52
30	16·4	7·66	35·23	28·31	27·52
40	21·8	7·67	35·21	28·30	27·51
46	25·1	7·68	35·21	28·30	27·51
Bottom rocky and very uneven: soundings were obtained in 47, 46, and 40 metres (25·7, 25·1 and 21·8 fathoms).					
6th May, 1903.					
0	0	9·70	34·81	27·98	26·88
5	2·7	9·62	34·79	27·96	26·87
10	5·4	9·60	34·79	27·96	26·87
15	8·2	9·54	34·79	27·96	26·88
20	10·9	9·53	34·80	27·97	26·90
32	17·5	9·52	34·80	27·97	26·90
Bottom uneven: 40 metres = 21·8 fathoms. Rock and sand.					
7th August, 1903.					
0	0	16·67	34·89	28·04	25·53
5	2·7	16·50	34·86	28·01	25·54
10	5·4	16·54	34·87	28·02	25·54
15	8·2	16·25	34·89	28·04	25·63
20	10·9	16·25	34·87	28·02	25·61
30	16·4	16·25	34·87	28·02	25·61
40	21·8	16·25	34·85	28·00	25·59
50	27·3	16·24	34·87	28·02	25·61
60	32·8	16·25	34·89	28·04	25·63
Bottom hard and very uneven. Surface temperature varied from 16·67° to 17·13° in course of work.					
12th November, 1903.					
0	0	12·15	34·77	27·94	26·40
5	2·7	12·15	34·72	27·90	26·36
10	5·4	12·15	34·74	27·92	26·38
15	8·2	12·15	34·74	27·92	26·38
22	12·0	12·15	34·74	27·92	26·38
31	16·9	12·15	34·74	27·92	26·38
Water bottle touched bottom at 22 and 31 metres (12·0 and 16·9 fathoms). Coarse sand and fine gravel.					

TABLE 6—*continued.*

Station E. 15.

50° 27′ N. Latitude. 1° 50′ W. Longitude.

M.	F.	t.°	S.°/₀₀	σ_0	σ_t
13th February, 1903.					
0	0	8·36	35·39	28·44	27·54
5	2·7	8·35	35·39	28·44	27·54
10	5·4	8·34	35·39	28·44	27·54
15	8·2	8·33	35·39	28·44	27·55
20	10·9	8·30	35·39	28·44	27·55
30	16·4	8·24	35·37	28·43	27·55
40	21·8	8·22	35·36	28·42	27·54
45	24·6	8·21	35·36	28·42	27·54
Bottom: 45 metres = 24·6 fathoms. Stones. Surface temperature with water bottle.					
5th May, 1903.					
0	0	9·46	35·06	28·17	27·10
5	2·7	9·40	35·05	28·16	27·10
10	5·4	9·40	35·05	28·16	27·10
15	8·2	9·40	35·05	28·16	27·10
20	10·9	9·40	35·05	28·16	27·10
30	16·4	9·40	35·05	28·16	27·10
36·5	19·9	9·40	35·05	28·16	27·10
Bottom: 38 metres = 20·8 fathoms. Hard, with a little sand.					
8th August, 1903.					
0	0	15·99	35·24	28·32	25·95
5	2·7	15·84	35·20	28·29	25·96
10	5·4	15·83	35·20	28·29	25·96
15	8·2	15·84	35·20	28·29	25·96
20	10·9	15·85	35·20	28·29	25·96
30	16·4	15·85	35·20	28·29	25·96
37	20·2	15·85	35·21	28·30	25·97
Bottom: 40 metres = 21·8 fathoms. Hard.					
12th November, 1903.					
0	0	12·57	35·14	28·24	26·61
5	2·7	12·65	35·10	28·21	26·56
10	5·4	12·65	35·10	28·21	26·56
15	8·2	12·65	35·10	28·21	26·56
20	10·9	12·65	35·10	28·21	26·56
34	18·6	12·66	35·10	28·21	26·56
Bottom: 37 metres = 20·2 fathoms. Hard, with a little sand.					

Station E. 11.

50° 5′ N. Latitude. 1° 58′ W. Longitude.

12th February, 1903.					
0	0	9·09	35·48	28·51	27·49
5	2·7	9·26	35·48	28·51	27·47
10	5·4	9·26	35·48	28·51	27·47
15	8·2	9·25	35·44	28·48	27·44
20	10·9	9·26	35·46	28·50	27·46
30	16·4	9·28	35·44	28·48	27·43
40	21·8	9·26	35·46	28·50	27·46
50	27·3	9·25	35·46	28·50	27·46
58	31·7	9·27	35·46	28·50	27·45
Bottom: 62 metres = 33·9 fathoms. Stones.					
8th May, 1903.					
0	0	10·14	35·37	28·43	27·24
5	2·7	9·95	35·34	28·40	27·25
10	5·4	9·99	35·34	28·40	27·24
15	8·2	9·95	35·33	28·39	27·23
20	10·9	9·94	Sample lost.		
30	16·4	9·94	35·32	28·38	27·23
40	21·8	9·93	35·32	28·38	27·23
50	27·3	9·93	35·32	28·38	27·23
60	32·8	9·93	35·32	28·38	27·23
Bottom: 61 metres = 33·3 fathoms. Stones and coarse sand.					
6th August, 1903.					
0	0	14·89	35·26	28·34	26·22
5	2·7	14·75	35·23	28·31	26·22
10	5·4	14·76	35·24	28·32	26·22
15	8·2	14·74	35·25	28·32	26·23
20	10·9	14·74	35·25	28·32	26·23
30	16·4	14·73	35·24	28·32	26·22
40	21·8	14·74	35·25	28·32	26·23
50	27·3	14·74	35·24	28·32	26·23
62	33·9	14·73	35·23	28·31	26·23
Bottom: coarse sand.					
11th November, 1903.					
0	0	13·44	35·43	28·47	26·68
5	2·7	13·47	35·39	28·44	26·62
10	5·4	13·47	35·39	28·44	26·62
15	8·2	13·48	35·39	28·44	26·62
20	10·9	13·49	35·39	28·44	26·62
30	16·4	13·48	35·39	28·44	26·62
40	21·8	13·48	35·39	28·44	26·62
56	30·6	13·48	35·40	28·45	26·63
Bottom: 60 metres = 32·8 fathoms. Gravel and stones.					

Station E. 16.

50° 23′ N. Latitude. 2° 28′ W. Longitude.

13th February, 1903.					
0	0	—	35·15	28·25	—
5	2·7	7·96	35·14	28·24	27·41
10	5·4	7·94	35·14	28·24	27·41
15	8·2	7·94	35·14	28·24	27·41
20	10·9	7·95	35·14	28·24	27·41
30	16·4	7·93	35·12	28·22	27·39
40	21·8	7·93	35·12	28·22	27·39
51	27·9	7·94	35·12	28·22	27·39
Bottom: 51 metres = 27·9 fathoms.					
5th May, 1903.					
0	0	9·70	35·07	28·18	27·07
5	2·7	9·70	35·08	28·19	27·08
10	5·4	9·70	35·08	28·19	27·08
15	8·2	9·70	35·09	28·20	27·08
20	10·9	9·70	35·08	28·19	27·08
30	16·4	9·70	35·08	28·19	27·08
40	21·8	9·70	35·08	28·19	27·08
52	28·4	9·70	35·07	28·18	27·07
Bottom: 53 metres = 29 fathoms. Coarse sand.					
9th August, 1903.					
0	0	15·83	35·25	28·32	25·99
5	2·7	15·84	35·25	28·32	25·99
10	5·4	15·83	35·25	28·32	25·99
15	8·2	15·83	35·25	28·32	25·99
20	10·9	15·82	35·25	28·32	25·99
30	16·4	15·82	35·24	28·32	25·99
40	21·8	15·80	35·25	28·32	26·00
48	26·2	15·80	35·25	28·32	26·00
Bottom: 52 metres = 28·4 fathoms. Hard.					
12th November, 1903.					
0	0	12·47	35·12	28·22	26·61
5	2·7	12·49	35·06	28·17	26·55
10	5·4	12·50	35 06	28·17	26·55
15	8·2	12·50	35·06	28·17	26·55
20	10·9	12·51	35·05	28·16	26·54
30	16·4	12·51	35·05	28·16	26·54
40	21·8	12·51	35·07	28·17	26·55
52	28·4	12·51	35·07	28·17	26·55
Bottom: 54 metres = 29·5 fathoms. Gravel					

TABLE 6—*continued.*

STATION E. 10.

49° 49′ N. Latitude. 2° 33′ W. Longitude.

M.	F.	t.°	S.°/₀₀	σ_0	σ_t
11th February, 1903.					
0	0	9·40	35·46	28·50	27·43
5	2·7	9·47	35·46	28·50	27·42
10	5·4	9·47	35·44	28·48	27·40
15	8·2	9·46	35·46	28·50	27·42
20	10·9	9·46	35·44	28·48	27·40
30	16·4	9·46	35·44	28·48	27·40
40	21·8	9·45	35·44	28·48	27·40
50	27·3	9·45	35·44	28·48	27·40
75	41·0	9·45	35·44	28·48	27·40
92	50·3	9·46	35·43	28·47	27·39
170	92·9	9·47	35·46	28·50	27·42

Bottom: At beginning 92 metres, afterwards 170 metres (50·3 and 92·9 fathoms), the boat having drifted over the deepest part of Hurds Deep.
Small stones, coarse sand, and shell.

M.	F.	t.°	S.°/₀₀	σ_0	σ_t
8th May, 1903.					
0	0	9·93	35·30	28·37	27·22
5	2·7	9·93	35·37	28·43	27·28
10	5·4	9·95	35·36	28·42	27·26
15	8·2	9·95	35·36	28·42	27·26
20	10·9	9·95	Sample lost.		
30	16·4	9·95	35·36	28·42	27·26
40	21·8	9·95	35·36	28·42	27·26
50	27·3	9·94	35·37	28·43	27·28
75	41·0	9·92	35·39	28·44	27·29
100	54·7	9·91	35·35	28·41	27·26
150	82·0	9·91	35·35	28·41	27·26

Bottom: 160 metres = 87·5 fathoms.
Sand and shell.
Very strong tide.

M.	F.	t.°	S.°/₀₀	σ_0	σ_t
6th August, 1903.					
0	0	15·03	35·35	28·41	26·26
5	2·7	14·62	35·32	28·38	26·32
10	5·4	14·40	35·32	28·38	26·36
15	8·2	14·40	35·32	28·38	26·36
20	10·9	14·39	35·32	28·38	26·36
30	16·4	14·39	35·32	28·38	26·36
40	21·8	14·37	35·32	28·38	26·37
50	27·3	14·34	35·32	28·38	26·37
75	41·0	14·32	35·32	28·38	26·38
100	54·7	14·27	35·34	28·40	26·41
130	71·1	14·26	35·34	28·40	26·41

Bottom: From 85 metres to 146 metres = 46·5 to 79·8 fathoms.
Hard. Strong tide.

M.	F.	t.°	S.°/₀₀	σ_0	σ_t
10th November, 1903.					
0	0	13·63	35·44	28·48	26·62
5	2·7	13·81	Sample lost.		
10	5·4	13·80	35·37	28·43	26·54
15	8·2	13·81	35·37	28·43	26·54
20	10·9	13·81	35·37	28·43	26·54
30	16·4	13·81	35·38	28·44	26·55
40	21·8	13·81	35·37	28·43	26·54
50	27·3	13·79	35·36	28·42	26·53
75	41·0	13·79	35·36	28·42	26·53
110	60·1	13·79	35·38	28·44	26·55

Bottom: 130 metres = 71·1 fathoms.
Hard.

STATION E. 17.

50° 11′ N. Latitude. 2° 52′ W. Longitude.

13th February, 1903.					
0	0	9·40	35·42	28·47	27·40
5	2·7	9·42	35·46	28·50	27·43
10	5·4	9·43	35·45	28·49	27·42
15	8·2	9·43	35·48	28·51	27·44
20	10·9	9·43	35·47	28·51	27·44
30	16·4	9·43	35·46	28·50	27·43
40	21·8	9·44	35·46	28·50	27·43
50	27·3	9·43	35·46	28·50	27·43
56	30·6	9·43	35·46	28·50	27·43

Surface temperature with water bottle.
Bottom: 58 metres = 31·7 fathoms.
Coarse sand and gravel.

4th May, 1903.					
0	0	—	35·34	28·40	—
5	2·7	9·71	35·32	28·38	27·27
10	5·4	9·70	35·32	28·38	27·27
15	8·2	9·68	35·33	28·39	27·28
20	10·9	9·67	35·33	28·39	27·28
30	16·4	9·66	35·32	28·38	27·27
40	21·8	9·67	35·33	28·39	27·28
50	27·3	9·66	35·34	28·40	27·29
62	33·9	9·64	35·35	28·41	27·30

Bottom: 64 metres = 35·0 fathoms.
Sand, shell, and gravel.

12th August, 1903.					
0	0	14·77	35·35	28·41	26·31
5	2·7	14·52	35·34	28·40	26·36
10	5·4	14·52	35·33	28·39	26·35
15	8·2	14·50	35·34	28·40	26·36
20	10·9	14·50	35·34	28·40	26·36
30	16·4	14·50	35·34	28·40	26·36
40	21·8	14·50	35·34	28·40	26·36
50	27·3	14·50	35·34	28·40	26·36
60	32·8	14·50	35·34	28·40	26·36

Bottom: 64 metres = 35 fathoms.
Sand and fine gravel.

13th November, 1903.					
0	0	13·06	35·39	28·44	26·70
5	2·7	13·09	35·37	28·43	26·69
10	5·4	13·09	35·37	28·43	26·69
15	8·2	13·11	35·37	28·43	26·68
20	10·9	13·11	35·37	28·43	26·68
30	16·4	13·11	35·37	28·43	26·68
40	21·8	13·11	35·37	28·43	26·68
58	31·7	13·11	35·37	28·43	26·68

Bottom: 60 metres = 32·8 fathoms.
Gravel.

STATION E. 18.

50° 23′ N. Latitude. 3° 8′ W. Longitude.

13th February, 1903.					
0	0	8·55	35·26	28·34	27·41
5	2·7	8·56	35·26	28·34	27·41
10	5·4	8·56	35·27	28·35	27·41
15	8·2	8·57	35·26	28·34	27·41
20	10·9	8·57	35·27	28·35	27·42
30	16·4	8·56	35·26	28·34	27·41
40	21·8	8·53	35·25	28·32	27·40
47	25·7	8·53	35·25	28·32	27·40

Surface temperature with water bottle.
Water bottle lost by wire breaking.
Bottom: 48 metres = 26·2 fathoms.
Dark sand and mud.
Slightly to the north of true position.

4th May, 1903.					
0	0	9·97	35·27	28·35	27·19
5	2·7	9·61	35·26	28·34	27·25
10	5·4	9·53	35·26	28·34	27·26
15	8·2	9·50	35·25	28·32	27·25
20	10·9	9·50	35·26	28·34	27·26
30	16·4	9·50	35·26	28·34	27·26
40	21·8	9·50	35·26	28·34	27·26
53	29·0	9·50	35·27	28·35	27·27

Bottom: 55 metres = 30·1 fathoms.
Sand and shell.

10th August, 1903.					
0	0	15·59	35·32	28·38	26·10
5	2·7	15·49	35·30	28·37	26·12
10	5·4	15·45	35·30	28·37	26·13
15	8·2	15·24	35·32	28·38	26·18
20	10·9	15·20	35·32	28·38	26·19
30	16·4	15·10	35·32	28·38	26·21
40	21·8	15·06	35·30	28·37	26·21
50	27·3	15·04	35·29	28·36	26·21

Bottom: 54 metres = 29·5 fathoms.
Sand and fine broken shell: "change of the ground."
Too rough to use vertical haul net.

13th November, 1903.					
0	0	12·88	35·32	28·38	26·68
5	2·7	12·93	35·32	28·38	26·67
10	5·4	12·93	35·32	28·38	26·67
15	8·2	12·93	35·30	28·37	26·66
20	10·9	12·93	35·30	28·37	26·66
30	16·4	12·93	35·30	28·37	26·66
40	21·8	12·94	35·30	28·37	26·66
57	31·2	12·94	35·30	28·37	26·66

Bottom: 57 metres = 31·2 fathoms.
Grey sand.

TABLE 6—*continued.*

STATION E. 9.

49° 39′ N. Latitude. 3° 9′ W. Longitude.

M.	F.	t.°	S.°/₀₀	σ_0	σ_t	M.	F.	t.°	S.°/₀₀	σ_0	σ_t	M.	F.	t.°	S.°/₀₀	σ_0	σ_t	M.	F.	t.°	S.°/₀₀	σ_0	σ_t
11th February, 1903.						9th May, 1903.						6th August, 1903.						10th November, 1903.					
0	0	9·78	35·45	28·49	27·36	0	0	9·72	35·32	28·38	27·26	0	0	14·51	35·43	28·47	26·43	0	0	13·53	35·44	28·48	26·64
5	2·7	9·81	35·41	28·46	27·32	5	2·7	9·78	35·32	28·38	27·25	5	2·7	14·40	35·43	28·47	26·45	5	2·7	13·65	35·43	28·47	26·61
10	5·4	9·83	35·40	28·45	27·31	10	5·4	9·77	35·32	28·38	27·25	10	5·4	14·39	35·42	28·47	26·45	10	5·4	13·65	35·43	28·47	26·61
15	8·2	9·82	35·41	28·46	27·32	15	8·2	9·78	Sample lost.			15	8·2	14·39	35·41	28·46	26·44	15	8·2	13·65	35·43	28·47	26·61
20	10·9	9·81	35·42	28·47	27·33	20	10·9	9·76	35·32	28·38	27·25	20	10·9	14·39	35·41	28·46	26·44	20	10·9	13·65	35·41	28·46	26·60
30	16·4	9·83	35·43	28·47	27·33	30	16·4	9·76	35·32	28·38	27·25	30	16·4	14·39	35·40	28·45	26·43	30	16·4	13·66	35·41	28·46	26·60
40	21·8	9·81	35·43	28·47	27·33	40	21·8	9·76	35·32	28·38	27·25	40	21·8	14·39	35·40	28·45	26·43	40	21·8	13·66	35·43	28·47	26·61
50	27·3	9·81	35 43	28·47	27·33	50	27·3	9·76	35·32	28·38	27·25	50	27·3	14·40	35·41	28·46	26·44	50	27·3	13·66	35·44	28·48	26·62
66	36·1	9·81	35 44	28·48	27·34	70	38·3	9·76	35·32	28·38	27·25	63	34·5	14·39	35·41	28·46	26·44	74	40·4	13·68	35·45	28·49	26·63
Bottom: 69 metres = 37·7 fathoms.						Bottom: 74 metres = 40·4 fathoms. Gravel, sand, and shell.						Bottom: 65 metres = 35·5 fathoms. Sand, shell, and gravel.						Bottom: 77 metres = 42·1 fathoms. Sand, shell; afterwards rock.					

STATION E. 19.

49° 56′ N. Latitude. 3° 23′ W. Longitude.

14th February, 1903.						4th May, 1903.						12th August, 1903.						13th November, 1903.					
0	0	9·64	35·49	28·52	27·41	0	0	10·08	35·49	28·52	27·33	0	0	14·98	35·36	28·42	26·27	0	0	12·93	35·44	28·48	26·77
5	2·7	9·65	35·46	28·50	27·39	5	2·7	9·98	35·49	28·52	27·36	5	2·7	14·58	35·36	28·42	26·37	5	2·7	13·09	35·40	28·45	26·70
10	5·4	9·65	35·46	28·50	27·39	10	5·4	9·99	35·48	28·51	27·35	10	5·4	14·39	35·37	28·43	26·41	10	5·4	13·09	35·41	28·46	26·71
15	8·2	9·66	35·46	28·50	27·39	15	8·2	9·98	35·48	28·51	27·35	15	8·2	14·39	35·38	28·44	26·42	15	8·2	13·09	35·43	28·47	26·72
20	10·9	9·66	35·47	28·51	27·40	20	10·9	9·98	35·48	28·51	27·35	20	10·9	14·38	35·38	28·44	26·42	20	10·9	13·10	35·43	28·47	26·72
30	16·4	9·66	35·46	28·50	27·39	30	16·4	9·98	35·48	28·51	27·35	30	16·4	14·38	35·38	28·44	26·42	30	16·4	13·10	35·43	28·47	26·72
40	21·8	9 67	35·45	28·50	27·39	40	21·8	9·97	35·48	28·51	27·35	40	21·8	14·38	35·40	28·45	26·43	40	21·8	13·10	35·43	28·47	26·72
50	27·3	9·67	35·45	28·50	27·39	50	27·3	9·98	35·49	28·52	27·36	50	27·3	14·38	35·40	28·45	26·43	50	27·3	13·10	35·43	28·47	26·72
72	39·3	9·67	35·47	28·51	27·40	67	36·6	9·97	35·48	28·51	27·35	69	37·7	14·38	35·39	28·44	26·42	67	36·6	13·10	35·43	28·47	26·72
Surface temperature measured with water bottle. Bottom: 73 metres = 39·9 fathoms. Coarse sand and gravel.						Bottom: 70 metres = 38·3 fathoms. Sand, shell, &c.						Bottom 69 metres = 37·7 fathoms. Broken shell-gravel and sand. Bottom very uneven.						Bottom: 70 metres = 38·3 fathoms.					

STATION E. 8.

49° 16′ N. Latitude. 3° 37′ W. Longitude.

11th February, 1903.						9th May, 1903.						5th August, 1903.						10th November, 1903.					
0	0	9·78	35·41	28·46	27·33	0	0	10·47	35·37	28·43	27·18	0	0	15·13	35·48	28·51	26·33	0	0	13·20	35·43	28·47	26·70
5	2·7	9·85	35·39	28·44	27·30	5	2·7	10·30	35·37	28·43	27·22	5	2·7	15·04	35·46	28·50	26·34	5	2·7	13·38	35·37	28·43	26·62
10	5·4	9·85	35·41	28·46	27·32	10	5·4	10·25	35·37	28·43	27·23	10	5·4	15·05	35·45	28·50	26·34	10	5·4	13·38	35·37	28·43	26·62
15	8·2	9·85	35·40	28·45	27·31	15	8·2	10·25	35·37	28·43	27·23	15	8·2	14·86	35·48	28·51	26·39	15	8·2	13·38	35·39	28·44	26·63
20	10·9	9·85	35·40	28·45	27·31	20	10·9	10·25	35·39	28·44	27·24	20	10·9	14·54	35·44	28·48	26·43	20	10·9	13·38	35·37	28·43	26·62
30	16·4	9·86	35·40	28·45	27·31	30	16·4	10·23	35·35	28·41	27·21	30	16·4	14·45	35·44	28·48	26·45	30	16·4	13·37	35·36	28·43	26·61
40	21·8	9·88	35·39	28·44	27·29	40	21·8	10·23	Bottle cracked.			40	21·8	14·38	35·43	28·47	26·45	40	21·8	13·38	35·37	28·43	26·62
50	27·3	9·85	35·39	28·44	27·30	50	27·3	10·24	35·35	28·41	27·21	50	27·3	14·27	35·44	28·48	26·49	50	27·3	13·37	35·37	28·43	26·62
80	43·7	9·85	35·40	28·45	27·30	77	42·1	10·24	35·37	28·43	27·23	77	42·1	14·26	35·44	28·48	26·49	78	42·6	13·37	35·37	28·43	26·62
Bottom: 83 metres = 45·4 fathoms.						Bottom: 80 metres = 43·7 fathoms. Coarse sand and shell.						Bottom: 80 metres = 43·7 fathoms. Shell and sand.						Bottom: 81 metres = 44·3 fathoms. Coarse sand and shell.					

TABLE 6—*continued.*

STATION E. 20.

50° 8′ N. Latitude. 3° 47′ W. Longitude.

M.	F.	t.°	S.°/₀₀	σ_0	σ_t
14th February, 1903.					
0	0	9·07	35·25	28·32	27·31
5	2·7	9·06	35·25	28·32	27·31
10	5·4	9·06	35·25	28·32	27·31
15	8·2	9·07	35·25	28·32	27·31
20	10·9	9·08	35·25	28·32	27·31
30	16·4	9·07	35·25	28·32	27·31
40	21·8	9·08	35·24	28·32	27·31
50	27·3	9·08	35·25	28·32	27·31
68	37·2	9·08	35·25	28·32	27·31

Bottom : 68 metres = 37·2 fathoms.
Surface temperature measured with water bottle.

M.	F.	t.°	S.°/₀₀	σ_0	σ_t
2nd May, 1903.					
0	0	9·86	35·30	28·37	27·23
5	2·7	9·65	35·20	28·29	27·19
10	5·4	9·65	35·20	28·29	27·19
15	8·2	9·63	35·25	28·32	27·22
20	10·9	9·62	35·25	28·32	27·22
30	16·4	9·63	35·24	28·32	27·22
40	21·8	9·58	35·24	28·32	27·23
50	27·3	9·58	35·24	28·32	27·23
63	34·4	9·58	35·24	28·32	27·23

Bottom : 64 metres = 35·0 fathoms.
The surface temperature is doubtful.
Owing to the high sea, it was not possible to carry out the plankton work, and the whole series of observations were repeated a week later.

M.	F.	t.°	S.°/₀₀	σ_0	σ_t
12th August, 1903.					
0	0	14·37	35·35	28·41	26·40
5	2·7	14·11	35·35	28·41	26·45
10	5·4	14·11	35·35	28·41	26·45
15	8·2	14·10	35·35	28·41	26·45
20	10·9	14·10	35·35	28·41	26·45
30	16·4	14·08	35·35	28·41	26·46
40	21·8	14·07	35·35	28·41	26·46
50	27·3	14·06	35·35	28·41	26·46
65	35·5	14·06	35·35	28·41	26·46

Bottom : 68 metres = 37·2 fathoms.
Shell and sand.

M.	F.	t.°	S.°/₀₀	σ_0	σ_t
13th November, 1903.					
0	0	12·84	35·29	28·36	26·67
5	2·7	12·87	35·26	28·34	26·64
10	5·4	12·87	35·26	28·34	26·64
15	8·2	12·88	35·26	28·34	26·64
20	10·9	12·89	35·26	28·34	26·64
30	16·4	12·91	35·26	28·34	26·63
40	21·8	12·91	35·26	28·34	26·63
50	27·3	12·91	35·26	28·34	26·63
65	35·5	12·91	35·28	28·35	26·64

Bottom : 68 metres = 37·2 fathoms.
Shell and gravel.

STATION E. 20.

February, 1903.					
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—	—	—	—	—	—
—	—	—	—	—	—
—	—	—	—	—	—
—	—	—	—	—	—

Second set of observations. 9th May, 1903.					
0	0	10·23	35·32	28·38	27·18
5	2·7	10·18	35·30	28·37	27·18
10	5·4	10·16	35·30	28·37	27·18
15	8·2	10·16	Bottle cracked.		
20	10·9	10·14	35·30	28·37	27·18
30	16·4	10·14	35·30	28·37	27·18
40	21·8	10·14	35·30	28·37	27·18
50	27·3	10·14	35·30	28·37	27·18
61	33·4	10·13	35·30	28·37	27·18

Bottom : 64 metres = 35·0 fathoms.
Broken shell.

August, 1903.					
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November, 1903.					
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STATION E. 1.

50° 2′ N. Latitude. 4° 22′ W. Longitude.

5th February, 1903.					
0	0	9·30	35·35	28·41	27·36
5	2·7	9·37	35·34	28·40	27·34
10	5·4	9·37	35·34	28·40	27·34
15	8·2	9·37	35·35	28·41	27·35
20	10·9	9·36	35·34	28·40	27·34
30	16·4	9·36	35·35	28·41	27·35
40	21·8	9·36	35·33	28·39	27·33
50	27·3	9 37	35·34	28·40	27·34
71	38·8	9·36	35·37	28·43	27·37

Bottom : 72 metres = 39·4 fathoms.

First set of observations. 2nd May, 1903.					
0	0	10·21	35·44	28·48	27·28
5	2·7	10·10	35·44	28·48	27·30
10	5·4	10·00	35·44	28·48	27·32
15	8·2	9·97	35·43	28·47	27·31
20	10·9	9·96	35·43	28·47	27·31
30	16·4	9·96	35·43	28·47	27·31
40	21·8	9·95	35·44	28·48	27·33
50	27·3	9·95	35·44	28·48	27·33
73	39·9	9·95	35·44	28·48	27·33

Bottom : 76 metres = 41·2 fathoms.
Sand.

26th August, 1903.					
0	0	14·25	35·32	28·38	26·39
5	2·7	14·12	35·34	28·40	26·44
10	5·4	14·12	35·34	28·40	26·44
15	8·2	14·04	35·35	28·41	26·47
20	10·9	13·96	35·35	28·41	26·49
30	16·4	13·04	35·38	28·44	26·70
40	21·8	13·03	35·38	28·44	26·70
50	27·3	13·02	35·39	28·44	26·71
68	37·2	12·98	35·39	28·44	26·72

Bottom : 72 metres = 39·4 fathoms.
Shell and sand.

3rd November, 1903.					
0	0	13·11	35·34	28·40	26·65
5	2·7	13·02	35·34	28·40	26·67
10	5·4	13·02	35·33	28·39	26·66
15	8·2	13·02	35·34	28·40	26·67
20	10·9	13·02	35·34	28·40	26·67
30	16·4	13·02	35·35	28·41	26·68
40	21·8	13·02	35·35	28·41	26·68
50	27·3	13·03	35·34	28·40	26·67
70	38·2	13·03	35·33	28·39	26·66

Bottom : 74 metres = 40·5 fathoms.
Fine grey sand.

TABLE 6—*continued.*

STATION E. 1.

February, 1903.						Second set of observations. 9th May, 1903.						August, 1903.						November, 1903.					
M.	F.	t.°	S.°/₀₀	σ_0	σ_t	M.	F.	t.°	S.°/₀₀	σ_0	σ_t	M.	F.	t.°	S.°/₀₀	σ_0	σ_t	M.	F.	t.°	S.°/₀₀	σ_0	σ_t
—	—	—	—	—	—	0	0	11·13	35·48	28·51	27·14	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	5	2·7	11·20	35·44	28·48	27·10	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	10	5·4	11·20	35·44	28·48	27·10	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	15	8·2	11·20	35·44	28·48	27·10	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	20	10·9	10·40	35·44	28·48	27·24	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	30	16·4	10·10	35·44	28·48	27·30	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	40	21·8	10·10	35·44	28·48	27·30	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	50	27·3	10·10	35·44	28·48	27·30	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	73	39·9	10·10	35·44	28·48	27·30	—	—	—	—	—	—	—	—	—	—	—	—
						Bottom: 75 metres = 41·0 fathoms. Sand.																	

STATION E. 1.

February, 1903.						Third set of observations. 13th May, 1903.						August, 1903.						November, 1903.					
—	—	—	—	—	—	0	0	10·84	35·50	28·53	27·22*	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	5	2·7	10·83	Not properly stopped.			—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	10	5·4	10·82	35·50	28·53	27·22	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	15	8·2	10·74	35·49	28·52	27·22	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	20	10·9	10·65	35·48	28·51	27·23	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	30	16·4	10·30	35·48	28·51	27·29	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	40	21·8	10·28	35·48	28·51	27·29	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	50	27·3	10·29	35·48	28·51	27·29	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	73	39·9	10·25	35·48	28·51	27·30	—	—	—	—	—	—	—	—	—	—	—	—
						* The surface temperature above was taken at 11.34 p.m.; the following at 10.4 p.m.																	
—	—	—	—	—	—	0	0	10·30	35·49	28·52	27·30	—	—	—	—	—	—	—	—	—	—	—	—
						Bottom: 75 metres = 41·0 fathoms.																	

STATION E. 2.

49° 27′ N. Latitude. 4° 42′ W. Longitude.

6th February, 1903.						14th May, 1903.						26th August, 1903.						3rd November, 1903.					
0	0	10·26	35·44	28·48	27·27	0	0	10·50	35·42	28·47	27·21	0	0	14·82	35·46	28·50	26·39	0	0	13·11	35·34	28·40	26·65
5	2·7	10·30	35·44	28·48	27·26	5	2·7	10·43	35·41	28·46	27·21	5	2·7	14·61	35·46	28·50	26·43	5	2·7	13·11	35·32	28·38	26·63
10	5·4	10·29	35·44	28·48	27·26	10	5·4	10·43	35·41	28·46	27·21	10	5·4	14·36	35·41	28·46	26·45	10	5·4	13·12	35·32	28·38	26·63
15	8·2	10·29	35·44	28·48	27·26	15	8·2	10·42	35·40	28·45	27·21	15	8·2	13·94	35·46	28·50	26·58	15	8·2	13·11	35·32	28·38	26·63
20	10·9	10·29	35·43	28·47	27·25	20	10·9	10·42	35·41	28·46	27·22	20	10·9	13·90	35·44	28·48	26·56	20	10·9	13·12	35·32	28·38	26·63
30	16·4	10·31	35·44	28·48	27·26	30	16·4	10·42	35·41	28·46	27·22	30	16·4	13·82	35·46	28·50	26·60	30	16·4	13·12	35·32	28·38	26·63
40	21·8	10·28	35·45	28·49	27·27	40	21·8	10·42	35·41	28·46	27·22	40	21·8	13·82	35·46	28·50	26·60	40	21·8	13·11	35·33	28·39	26·64
50	27·3	10·29	35·44	28·48	27·26	50	27·3	10·42	35·41	28·46	27·22	50	27·3	13·82	35·46	28·50	26·60	50	27·3	13·11	35·32	28·38	28·63
75	41·0	10·28	35·43	28·47	27·25	75	41·0	10·42	35·41	28·46	27·22	90	49·2	13·82	35·46	28·50	26·60	75	41·0	13·11	35·32	28·38	26·63
97	53·0	10·28	35·43	28·47	27·25	92	50·3	10·42	35·43	28·47	27·23							96	52·5	13·11	35·33	28·39	26·64
Bottom: 108 metres = 59 fathoms.						Bottom: 94 metres = 51·4 fathoms. Sand, gravel, and a little fine grey mud.						Bottom: 94 metres = 51·4 fathoms. Broken shell and gravel.						Bottom: 98 metres = 53·6 fathoms. Sand, shell, and gravel.					

TABLE 6—*continued.*

STATION E. 3.

48° 34′ N. Latitude. 5° 13′ W. Longitude.

M.	F.	t.°	S.°/₀₀	σ_0	σ_t
6th—7th February, 1903.					
0	0	10·52	35·52	28·54	27·27
5	2·7	10·50	35·53	28·56	27·29
10	5·4	10·53	35·52	28·54	27·27
15	8·2	10·52	35·53	28·56	27·29
20	10·9	10·52	35·53	28·56	27·29
30	16·4	10·52	35·54	28·56	27·30
40	21·8	10·50	35·54	28·56	27·30
50	27·3	10·53	35·53	28·56	27·29
75	41·0	10·50	35·53	28·56	27·29
110	60·1	10·51	35·53	28·56	27·29
116	63·4	10·51	35·52	28·54	27·27
Bottom : 116 metres = 63·4 fathoms.					

M.	F.	t.°	S.°/₀₀	σ_0	σ_t
14th May, 1903.					
0	0	11·31	35·53	28·56	27·16
5	2·7	11·29	Bottle cracked.		
10	5·4	11·29	35·50	28·53	27·13
15	8·2	11·28	35·50	28·53	27·13
20	10·9	11·29	35·51	28·54	27·13
30	16·4	11·28	35·50	28·53	27·13
40	21·8	11·27	35·51	28·54	27·13
50	27·3	11·27	35·52	28·54	27·14
75	41·0	11·26	35·51	28·54	27·13
105	57·4	11·25	35·51	28·54	27·13
Bottom : 110 metres = 60·1 fathoms.					

M.	F.	t.°	S.°/₀₀	σ_0	σ_t
1st September, 1903.					
0	0	15·72	35·31	28·38	26·06
5	2·7	15·50	35·31	28·38	26·11
10	5·4	13·38	35·44	28·48	26·67
15	8·2	13·28	35·46	28·50	26·71
20	10·9	13·27	35·45	28·50	26·71
30	16·4	13·21	35·45	28·50	26·72
40	21·8	13·10	35·44	28·48	26·73
50	27·3	13·04	35·44	28·48	26·74
75	41·0	13·00	35·43	28·47	26·74
110	60·1	12·87	35·43	28·47	26·77
Bottom : 114 metres = 62·3 fathoms. Shell.					

M.	F.	t.°	S.°/₀₀	σ_0	σ_t
4th November, 1903.					
0	0	13·33	35·46	28·50	26·70
5	2·7	13·41	35·44	28·48	26·67
10	5·4	13·43	35·44	28·48	26·66
15	8·2	13·44	35·43	28·47	26·65
20	10·9	13·45	35·44	28·48	26·66
30	16·4	13·45	35·48	28·51	26·69
40	21·8	13·45	35·48	28·51	26·69
50	27·3	13·45	35·48	28·51	26·69
75	41·0	13·45	35·48	28·51	26·69
113	61·8	13·45	35·48	28·51	26·69
Bottom : 113 metres = 61·8 fathoms. Very rough : lost vertical haul net. Fine broken shell.					

STATION E. 7.

49° 53′ N. Latitude. 5° 38′ W. Longitude.

8th February, 1903.					
0	0	9·59	35·41	28·46	27·36
5	2·7	9·57	35·37	28·43	27·34
10	5·4	9·59	35·38	28·44	27·34
15	8·2	9·59	35·39	28·44	27·34
20	10·9	9·59	35·41	28·46	27·36
30	16·4	9·59	35·40	28·45	27·35
40	21·8	9·55	35·41	28·46	27·37
50	27·3	9·55	35·39	28·44	27·35
72	39·4	9·55	35·40	28·45	27·36
Bottom : 76 metres = 41·5 fathoms.					

16th May, 1903.					
0	0	10·50	35·44	28·48	27·22
5	2·7	10·50	—	—	—
10	5·4	10·50	35·39	28·44	27·18
15	8·2	10·49	35·39	28·44	27·18
20	10·9	10·48	35·39	28·44	27·18
30	16·4	10·40	35·38	28·44	27·20
40	21·8	10·30	35·38	28·44	27·22
50	27·3	10·30	35·37	28·43	27·21
75	41·0	10·30	Bottle cracked.		
Bottom : 78 metres = 42·6 fathoms. Gravel and sand.					

28th August, 1903.					
0	0	14·67	35·37	28·43	26·35
5	2·7	14·46	35·36	28·43	26·39
10	5·4	14·41	35·37	28·43	26·41
15	8·2	14·39	35·37	28·43	26·41
20	10·9	14·37	35·37	28·43	26·42
30	16·4	12·30	35·47	28·51	26·91
40	21·8	12·28	35·46	28·50	26·91
50	27·3	12·24	35·46	28·50	26·92
74	40·4	12·20	35·46	28·50	26·93
Bottom : 77 metres = 42·1 fathoms. Fine shell and gravel.					

7th November, 1903.					
0	0	12·33	35·34	28·40	26·81
5	2·7	12·47	35·28	28·35	26·73
10	5·4	12·47	35·28	28·35	26·73
15	8·2	12·48	35·28	28·35	26·73
20	10·9	12·48	35·28	28·35	26·73
30	16·4	12·48	35·28	28·35	26·73
40	21·8	12·48	35·28	28·35	26·73
50	27·3	12·49	35·28	28·35	26·73
76	41·5	12·49	35·28	28·35	26·73
Bottom : 78 metres = 42·6 fathoms. Coarse shell.					

STATION E. 6.

50° 24′ N. Latitude. 6° 5′ W. Longitude.

9th February, 1903.					
0	0	9·39	35·41	28·46	27·39
5	2·7	9·25	35·39	28·44	27·40
10	5·4	9·25	35·36	28·43	27·38
15	8·2	9·26	35·37	28·43	27·39
20	10·9	9·26	35·37	28·43	27·39
30	16·4	9·25	35·37	28·43	27·39
40	21·8	9·25	35·38	28·44	27·39
50	27·3	9·25	35·43	28·47	27·43
83	45·4	9·25	35·44	28·48	27·44
Bottom : 87 metres = 47·6 fathoms.					

16th May, 1903.					
0	0	10·20	35·25	28·32	27·12
5	2·7	10·19	—	—	—
10	5·4	10·19	35·23	28·31	27·11
15	8·2	10·18	35·23	28·31	27·11
20	10·9	10·11	35·24	28·32	27·12
30	16·4	9·92	35·24	28·32	27·16
40	21·8	9·86	35·25	28·32	27·18
50	27·3	9·85	35·25	28·32	27·18
83	45·4	9·84	35·23	28·31	27·17
Bottom : 85 metres = 46·5 fathoms. Coarse sand and broken shell.					

August, 1903.					
—	—	—	—	—	—
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—	—	—	—	—	—
—	—	—	—	—	—
—	—	—	—	—	—
—	—	—	—	—	—
—	—	—	—	—	—
—	—	—	—	—	—
—	—	—	—	—	—

6th November, 1903.					
0	0	12·48	35·24	28·32	26·70
5	2·7	12·50	35·21	28·30	26·68
10	5·4	12·50	35·22	28·31	26·69
15	8·2	12·50	35·23	28·31	26·69
20	10·9	12·50	35·21	28·30	26·68
30	16·4	12·50	35·21	28·30	26·68
40	21·8	12·50	35·20	28·30	26·67
50	27·3	12·50	35·21	28·30	26·68
78	42·6	12·49	35·21	28·30	26·68
Bottom : 81 metres = 49·7 fathoms. Broken shell and coarse sand.					

TABLE 6—*continued.*

STATION E. 5.

49° 6′ N. Latitude. 6° 32′ W. Longitude.

M.	F.	t.°	S.°/₀₀	σ_0	σ_t
8th February, 1903.					
0	0	9·88	35·39	28·44	27·30
5	2·7	9·85	35·41	28·46	27·32
10	5·4	9·87	35·38	28·44	27·29
15	8·2	9·85	35·40	28·45	27·31
20	10·9	9·85	35·39	28·44	27·30
30	16·4	9·86	35·37	28·43	27·29
40	21·8	9·85	35·39	28·44	27·30
50	27·3	9·85	35·39	28·44	27·30
75	41·0	9·85	35·35	28·41	27·27
100	54·7	9·85	35·38	28·44	27·30
133	72·7	9·85	35·37	28·43	27·29
Bottom: 137 metres = 74·9 fathoms.					

M.	F.	t.°	S.°/₀₀	σ_0	σ_t
15th May, 1903.					
0	0	11·08	35·30	28·37	27·01
5	2·7	11·06	35·34	28·40	27·04
10	5·4	11·02	35·35	28·41	27·06
15	8·2	10·94	35·35	28·41	27·07
20	10·9	10·62	35·35	28·41	27·13
30	16·4	10·00	35·37	28·43	27·25
40	21·8	9·95	35·36	28·43	27·26
50	27·3	9·95	35·35	28·41	27·25
75	41·0	9·95	35·34	28·40	27·24
100	54·7	9·95	35·34	28·40	27·24
120	65·6	9·95	—	—	—
Bottom: 122 metres = 66·7 fathoms. Sand and shell.					

M.	F.	t.°	S.°/₀₀	σ_0	σ_t
2nd September, 1903.					
0	0	16·05	35·14	28·24	25·86
5	2·7	15·90	35·14	28·24	25·90
10	5·4	15·90	35·19	28·28	25·94
15	8·2	15·88	35·21	28·30	25·95
20	10·9	15·86	35·17	28·27	25·94
30	16·4	15·30	35·19	28·28	26·06
40	21·8	10·27	35·17	28·27	27·06
50	27·3	10·23	35·36	28·43	27·22
75	41·0	10·23	35·30	28·37	27·17
120	65·6	10·23	35·30	28·37	27·17
Bottom: 120 metres = 65·6 fathoms. Shell.					

M.	F.	t.°	S.°/₀₀	σ_0	σ_t
November, 1903.					
0	0	12·29	35·22	28·31	26·72
5	2·7	12·34	35·17	28·27	26·68
10	5·4	12·33	35·17	28·27	26·68
15	8·2	12·33	35·18	28·28	26·68
20	10·9	12·35	35·18	28·28	26·68
30	16·4	12·33	35·17	28·27	26·68
40	21·8	12·32	35·17	28·27	26·68
50	27·3	12·29	35·17	28·27	26·69
60	32·8	11·13	—	—	—
75	41·0	11·12	35·26	28·34	26·78
117	64·0	11·12	35·26	28·34	26·78
Bottom: 120 metres = 65·6 fathoms. Fine sand.					

STATION E. 4.

48° 27′ N. Latitude. 6° 35′ W. Longitude.

7th February, 1903.					
0	0	10·58	35·41	28·46	27·19
5	2·7	10·58	35·48	28·51	27·24
10	5·4	10·59	35·52	28·54	27·27
15	8·2	10·59	35·51	28·54	27·26
20	10·9	10·61	35·51	28·54	27·26
30	16·4	10·60	35·48	28·51	27·24
40	21·8	10·59	35·49	28·52	27·25
50	27·3	10·60	35·50	28·53	27·26
75	41·0	10·65	35·51	28·54	27·25
100	54·6	10·65	35·52	28·54	27·26
125	68·3	10·65	35·52	28·54	27·26
155	84·7	10·73	35·55	28·57	27·27
Bottom: 161 metres = 88·0 fathoms.					

15th May, 1903.					
0	0	11·32	—	—	—
5	2·7	11·19	35·55	28·57	27·19
10	5·4	11·18	35·55	28·57	27·19
15	8·2	11·18	—	—	—
20	10·9	11·02	—	—	—
30	16·4	10·78	35·55	28·57	27·26
40	21·8	10·74	35·55	28·57	27·27
50	27·3	10·74	35·55	28·57	27·27
75	41·0	10·70	35·55	28·57	27·27
100	54·6	10·74	35·57	28·59	27·29
130	71·0	10·72	35·57	28·59	27·29
163	91·8	10·72	35·57	28·59	27·29
Bottom: 166 metres = 90·7 fathoms. Fine sand and one piece of shell.					

1st September, 1903.					
0	0	16 49	35·25	28·32	25·84
5	2·7	16·38	35·29	28·36	25·90
10	5·4	16·38	35·34	28·40	25·94
15	8·2	16·27	35·34	28·40	25·97
20	10·9	16·05	35·34	28·40	26 02
30	16·4	15·76	35·39	28·44	26·12
40	21·8	13·06	35·45	28·49	26·75
50	27·3	11·30	35·52	28·54	27·14
75	41·0	11·16	35·50	28·53	27·16
100	54·6	11·12	35·48	28·51	27·14
148	80·9	11·07	35·50	28·53	27·17
Bottom: 154 metres = 84·2 fathoms. Fine sand and shell.					

4th November, 1903.					
0	0	12·83	35·41	28·46	26·76
5	2·7	12·93	35·33	28·39	26·68
10	5·4	12·93	35·33	28·39	26·68
15	8·2	12·93	35·33	28·39	26·68
20	10·9	12·93	35·32	28·38	26·67
30	16·4	12·93	35·33	28·39	26·68
40	21·8	12·93	35·34	28·40	26·69
50	27·3	12·77	35·48	28·51	26·83
75	41·0	12·61	35·48	28·51	26·86
115	62·8	12·61	35·48	28·51	26·86
Bottom: 124 metres = 67·8 fathoms. Gravel, shell, and sand. Rough sea; water bottle struck side of ship under water and broke thermometer.					

Charts and Sections.

Plates I. to IV. show the surface isotherms and isohalines for the four cruises over the regular area of investigation. The isotherms are drawn to whole degrees Centigrade, and the isohalines to 0·10°/$_{oo}$ S., the different salinities above 35·0 being distinguished by different shades of blue. The large figures on the charts refer to the areas and not to the isohalines: thus, 35·4 on an area means that all the water in this area, distinguished by the colour and the isohaline, has a salinity of between 35·40 and 35·50. On the sections, however, the isohalines are figured and not the areas, as this method is somewhat clearer for a small scale. The colours correspond in all the plates. In some cases the bottom limit of water of 35·4°/$_{oo}$ has also been drawn. The stations are distinguished by crosses surrounded by circles with the number preceded by E, while observations at the surface only are marked by crosses. Plate V. is a small scale chart of surface salinity over the Channel and the area to the west and south, compiled chiefly from samples collected for us on steamships running to Ireland and across the Bay of Biscay in November, 1903.

Plate VI. contains longitudinal and cross sections of the English Channel. The longitudinal sections are drawn through stations E. 5, E. 2, E. 19, E. 11, E. 13, E. 21, and E. 22, approximately coinciding with the centre line. The stations are marked over vertical lines in Arabic figures preceded by E., according to the system adopted in the Quarterly Bulletins of the Central Council. The line of stations, however, is not the same as that of the Bulletin. The cross sections were drawn by projecting stations E. 4, E. 5, E. 7, and E. 6 in an east and west direction on a straight line drawn from close to station E. 4, midway between the Scilly Isles and the mainland, into the Bristol Channel. Such a method is, of course, open to criticism, but it is at least as satisfactory as drawing a line from station to station, which at E. 7 would bend through an angle of nearly 70°. The same depth has been used for a station on each of the four cruises, though considerable differences were actually found, as might be expected considering the uneven nature of the bottom and the fact that in many cases positions could only be picked up by dead reckoning, the weather generally preventing an astronomical fix, except when equally good ones could be obtained by bearings of the land. The lines of equal temperature and salinity are drawn as on the surface charts, to whole degrees and 0·10°/$_{oo}$ S.

Table VII. gives the results of two sets of nearly continuous observations during 24 hours on station E. 1.

February, 1903.

In February no observations were made to the east of the Isle of Wight. The physical conditions were extremely simple, the water being as a rule of the same salinity and temperature from surface to bottom. On approaching the entrance to the Channel from the west the salinity rose from 35·3°/$_{oo}$ to 35·4°/$_{oo}$, about the longitude of the Scilly Isles. This water of 35·4°/$_{oo}$ filled nearly the whole of the area investigated, extending in a northerly direction west of Land's End into the Bristol Channel at least as far as station E. 6, and in an easterly and northerly direction up to the line joining the Isle of Wight and Cape Barfleur. Its southern boundary was not traced between Cape La Hague and Ushant, but as a few of the samples taken on station E. 8 had a salinity of 35·39°/$_{oo}$, it is fairly certain that it did not run far south of this point. Near Ushant, the salinity was 35·5°/$_{oo}$ at all depths, and this dense water extended as an undercurrent to station E. 4, appearing at this point at a depth of 10 metres, but not becoming permanent until a depth of 50 metres was reached. The salinity gradient surrounding the eastern portion of the 35·4°/$_{oo}$ S. area was very steep, a fall of 0·2°/$_{oo}$ salinity occurring in a few miles.

The larger part of the water had a temperature of above 9° C., but not reaching 11° C. An area of 11° C. extended into the Channel from the northern part of the Bay of Biscay in a wedge form, the base

including station E. 3 and E. 4, and the apex reaching a little to the north of station E. 2. To the north and east of this wedge, the temperature was 9° C. over the larger part of the Channel, the isotherm of 9° C. beginning near Start Point and following the isohaline of 35·4°/$_{oo}$ fairly closely as far as it was traced. The temperature gradient to 7° C. was steep and coincided approximately with the steep salinity gradient to the south of the Isle of Wight. The 8° C. isotherm ran from near Anvil Point in a south-easterly direction, passing to the south-west of stations E. 14 and E. 13, and following the 9° C. isotherm as far as mid-Channel—when it curved to the south and included station E. 12 (*see* Plate I.).

On examining the longitudinal and transverse sections (Plate VI.), it will be seen that water of 35·3°/$_{oo}$ entered the Channel as a wedge-shaped undercurrent in the centre line, bounded on the south and east entirely by water of 35·4°/$_{oo}$, and on the north extending into the Bristol Channel as a mid-water current with water of 35·4°/$_{oo}$ S. above and below it. To the eastward of this undercurrent, the longitudinal section calls for very little notice, the isotherms and isohalines being nearly vertical.

May, 1903.

In this month the area investigated was extended to the eastern portion of the Channel by the addition of stations E. 21 and E. 22, and by the observations made on Dr. Wolfenden's yacht *Silver Belle*. The conditions had changed during the interval, but not to any great extent. The area of 35·4°/$_{oo}$ water had contracted considerably; its western boundary still crossed the entrance to the Channel, but it no longer extended to station E. 6, and it is doubtful whether it reached the Bristol Channel at all. As far east as the Start it had been moved closer to the English shore, but beyond this point it diminished to a narrow tongue, and its eastern extremity was situated in mid-Channel, south of the western part of the Isle of Wight. Its southern boundary had retreated from the French shore, and now ran to the north of stations E. 10, E. 9, and E. 8 towards Ushant. The area of 35·5°/$_{oo}$ S. found near the latter point at the surface on the previous cruise, and as a bottom layer to the westward, had extended to the surface at station E. 4, and its northern extremity nearly reached station E. 2. A short distance to the west of Ushant a small patch of 35·6°/$_{oo}$ water was found on the surface, but there were no observations to show whether it reached any great depth or not. Across the entrance to the Channel the 35·2°/$_{oo}$ S. isohaline has been drawn close to that for 35·3°/$_{oo}$ S. As will be seen on referring to the chart, the grounds for doing so are slight, as only one sample was taken below 35·3°/$_{oo}$ S.; and it is rather from the analogy of subsequent observations than from any actual evidence that it has been inserted. The area of 35·4°/$_{oo}$ S. within the Channel was bordered by water of lower salinity to the north and south, the fringes of 35·2°/$_{oo}$ S. meeting in mid-Channel south of the Isle of Wight and extending towards Beachy Head, to the south of which point they included an area of high salinity, 35·4°/$_{oo}$, which as far as has been discovered, had no connection with the similar water to the west. The shape and size of this area during May is somewhat uncertain; its existence was not suspected, and therefore no special precautions were taken to collect a good line of samples across it: while the samples from the *Silver Belle* were taken nearly a fortnight later. To the south of the Isle of Wight and Selsea Bill, and to the north of the Bay of the Seine, the isohalines curved out from the shore, and were crowded together in a way that suggests large outrushes of fresh water.

Temperature.—As in February, we find an area of warm surface water entering the Channel from the south and west, but its temperature is now 11° C. against 10° C. during the previous cruise; its shape is somewhat different, the base of the wedge being broader and extending further to the north, while its apex fell short of station E. 2. To the north and east the temperature had risen from 9° C. to 10° C., while an axis of water of 11° C. occupied the centre of the Channel from the longitude of the Start to that of Cape La Hague. To the south of this, the temperature gradient was steeper than

to the north, though in each case the fall was only to 9° C. The isotherms to the east of the Isle of Wight have not been drawn, as the temperatures observed on the *Huxley* do not agree with those of the *Silver Belle*, and are insufficient by themselves : while the latter were taken nearly a fortnight later and were complicated by hot sunshine and calms. The extent to which such conditions influence observations is discussed later.

The tables and sections show that while during May there were no well-marked undercurrents of denser water, the fall of temperature with increase of depth had begun to manifest itself. This is particularly noticeable in the cross section of the entrance to the Channel. Here we find the tongue of water of 35·3°/$_{oo}$ S. entering in the centre line, and bounded, as before, on the south by denser water. On the north, however, the salinity falls to 35·2°/$_{oo}$ S., with the exception of a thin surface layer of 35·4°/$_{oo}$ S. at station E. 7. The larger part of the water in the cross section had a temperature of 10° C. ; but a thin surface layer of 11° C. extended from station E. 4 slightly to the north of the mid-Channel line, while in the centre, on station E. 5, an undercurrent of water of 9° C. was well marked entering the Channel from the west. This current was permanent for the rest of the year, and gradually rose in temperature up to November.

August, 1903.

In the interval between the May and August cruises the distribution of the water underwent a complete change, the division into layers of different salinity being more pronounced than at any other time of the year. Proceeding up Channel from west to east, we find on station E. 5 a surface salinity of 35·1°/$_{oo}$, rising to 35·2°/$_{oo}$ S. at a depth of 50 metres. The surface isohaline for 35·3°/$_{oo}$ had moved to the east, passing close to Land's End, and curving to the south and east, close to Ushant, instead of running to the west of station E. 4. The surface area of 35·4°/$_{oo}$ S. was now isolated, cut off from the Bay of Biscay by the advance of the fresher surface layer, but connected with it and with station E. 7 by a bottom layer extending to the west and south. On station E. 4 the surface salinity was only 35·2°/$_{oo}$, but as the depth increased the extension of the 35·4°/$_{oo}$ S. water was met, and finally a bottom layer of 35·5°/$_{oo}$ S. To the east, the 35·4°/$_{oo}$ S. isohaline did not extend as far as earlier in the year, and was rounded off in a sweeping curve, the narrow tongue found in May having disappeared. The isohaline of 35·3°/$_{oo}$ S. completely surrounded the 35·4°/$_{oo}$ S. water on the surfuce ; it passed close to Land's End and the Lizard, then curved into Eddystone Bay, and after running just to the south of the Start, swept into Great West Bay and round to the south towards the Channel Islands, where it was lost. The 35·2°/$_{oo}$ isohaline commenced near Anvil Point and ran south-east to about mid-Channel ; after this its course is uncertain, as the observations were not sufficient to show whether it was continued up Channel as in May, or turned south and west towards Cape La Hague. In the chart, the latter hypothesis has been assumed to be correct. Off the Isle of Wight and Selsea Bill, the isohalines still curve out from the shore as in May, but the corresponding conditions to the north of the Bay of the Seine were not traced, no observations being taken in this region. Further up Channel, we still find a patch of water south of Beachy Head of higher salinity than its surroundings, but it had fallen from 35·4°/$_{oo}$ S. to 35·2°/$_{oo}$ S. It may be objected, and with reason, that this is nothing more than a prolongation of the 35·2°/$_{oo}$ S. water of the western part of the Channel, and that the 35·4°/$_{oo}$ S. water of May had either disappeared entirely or that it was missed from want of observations far enough south.

Temperature.—On the surface, the temperature distribution was similar to that found in May, though the actual temperatures were much higher. A wedge-shaped area of warm water enters the Channel from the south and west, but its temperature has risen from 11° C. to 16° C. The next isotherm, 15° C., follows approximately the same course as the 10° isotherm of May, from Land's End along the English coast, and turning southward near the Isle of Wight ; but there the resemblance ceases, as it can be traced

back nearly to its starting point in a very irregular course, while the 9° C. line of May was lost as it approached the French coast to the west of the Channel Isles. Under the south coast of England a region of 16° C. was found between Anvil Point and Beachy Head, the temperature falling to 15° C. on proceeding further from the shore.

Below the surface, the temperature of the water falls rapidly to about 20 metres, and then is constant to the bottom as a general rule. It is impossible, however, to plot a temperature curve with any degree of accuracy unless all the observations on a station could be taken in a few minutes, instead of being spread over an hour or more. This point is well brought out by the observations taken on station E. 1 every two hours during the twenty-four.

On referring to Plate VI., we see that the water at the western entrance of the Channel is split up into layers of different temperature and salinity, which gradually merge in one another as we proceed to the east. The cross section shows the current of low salinity water entering from the west, bounded by denser water north and south, and itself composed of layers of varying salinity, from 35·14°/$_{oo}$ at the surface to 35·30°/$_{oo}$ at the bottom. The surface layer of high temperature running north from the Bay of Biscay is well marked and makes its influence felt as far as Land's End, its thickness being about 30 metres. In the centre line a cold bottom current is found, as in May, but its temperature has risen from 9° C. to 10° C. Further to the east the isohalines approach the vertical.

November, 1903.

In this month there is a return to somewhat simpler conditions. There is no well-marked division into layers of different salinity except at stations E. 4 and E. 5. The 35·3°/$_{oo}$ S. isohaline crossing the entrance to the Channel has retreated again towards the west ; it now runs approximately south from Land's End, and then, stopping short of station E. 4, sweeps round in a north-westerly direction to a point south of the Fastnet Rock, enclosing a tongue of surface water of low salinity flowing south from the St. George's and Bristol Channels (Plate V.). An isohaline of 35·4°/$_{oo}$ S. runs parallel to it a short distance to the south and west from the Irish coast to Ushant, while the water of 35·3°/$_{oo}$ S. enclosed between these lines spreads out to nearly the full width of the Channel, until it meets and surrounds an area of 35·4°/$_{oo}$ S. water which extends from the longitude of Plymouth to that of the western part of the Isle of Wight, and is possibly the area of the same salinity found further west in August, though the undercurrent connecting it with the Bay of Biscay has either been obliterated or reduced to small proportions. The surrounding border of 35·3°/$_{oo}$ S. water extends up Channel as far as observations were made ; it is constricted between the Isle of Wight and Cape Barfleur, but further east curves sharply towards the Bay of the Seine. Off Beachy Head we again meet an area of 35·4°/$_{oo}$ S. water, now much increased in size, and as before without any visible connection with the similar water of the western part of the Channel.

Returning to the west, it will be seen from Plate V. that water of 35·4°/$_{oo}$ S. fills nearly the whole of the Bay of Biscay east of longitude 8° W., and to the north extends towards the Irish coast as a strip about 30 miles wide. To the west of this again the water is 35·5°/$_{oo}$ S., and towards the south of the Bay of Biscay the salinity gradient is fairly steep up to at least 35·7°/$_{oo}$ S. Off the Spanish and Portuguese coast the salinity rises to 36·0°/$_{oo}$. The isotherms for this region are not drawn, as the data are insufficient, but they appear to curve round from the south coast of Ireland in the same way as the isohalines. The temperature in the Bay rises from 13° C. near Ushant to 15° C. near Cape Finisterre.

Temperature.— The temperature distribution is fairly easy to follow on the surface. In the centre line at the western entrance it rises from 11° C. to 12° C., and this latter temperature extends from

station E. 6 in the Bristol Channel to the Bay of Biscay. Near Ushant a temperature of 13° C. is found, and a broad axis of water of this temperature, not connected with the warm Ushant water, fills the western part of the Channel, and after passing Cape Barfleur, bends to the Bay of the Seine like the isohalines. The north-eastern boundary of this warm water does not quite reach the eastern patch of water of 35·4°/$_{oo}$ S., which has a temperature of 12° C.

Cross Section.

The surface temperature is generally lower than that in the depths, except on stations E. 4 and E. 5., where what may be called summer conditions still prevail. The difference is nowhere great, and layers of different salinity are only found at the western entrance. The sections here show the same general shape that has prevailed since May, though the conditions are less complicated than in August. As usual, there is a central current of low salinity, 35·2°/$_{oo}$, bounded by denser water on the south, but on the north extended as far as observations were made. The least salt part of this current is not now on the surface, but immediately beneath it, and reaches to a depth of 50 metres. From station E. 4 an undercurrent of 35·4°/$_{oo}$ S. water stretches a short distance in a northerly direction. The tongue of cold water in the mid-Channel line has now a temperature of 11° C., the highest of the year.

Before attempting to summarise the year's work, two other sets of observations must be discussed, *i.e.*, the temperature variations during the twenty-four hours, and the samples taken on the Newhaven-Caen line.

NEWHAVEN TO CAEN LINE.

In October arrangements were completed for taking surface samples and temperatures once a fortnight between Newhaven and Caen on the London, Brighton, and South Coast Railway Company's steamers. The temperatures were taken with Casella thermometers of the Meteorological Office pattern, divided to whole degrees Fahrenheit. The readings were made to quarters of a degree, and the nearest equivalent tenth of a degree Centigrade is given in the Table. The samples have proved particularly interesting, as the line crosses the area over which the patch of high salinity water found in the eastern part of the English Channel appears to oscillate. This patch was found in May, the salinity being 35·4°/$_{oo}$. In August the salinity had fallen to 35·2°/$_{oo}$, which was still appreciably higher than that of the surrounding water. The first set of the surface samples from the London, Brighton, and South Coast Railway Company's s.s. *Calvados* were taken on October 21st and 22nd, and the results up to the end of the year are given in the following Table :—

Newhaven–Caen Line.

October 21st and 22nd, 1903. S.S. *Calvados*.—F. Banks, Master.					November 4th and 5th, 1903. S.S. *Calvados*.—F. Banks, Master.				
50° 35′ N. Lat. 0° 3′ E. Long.	21.10.03 11.40 p.m.	14·6° C.	35·18°/$_{oo}$	Slack water.	50° 35′ N. Lat. 0° 2′ E. Long.	4.11.03 11.25 p.m.	13·3° C.	35·16°/$_{oo}$	1 hour ebb.
50° 23′ N. Lat. 0° 1′ W. Long.	22.10.03 1 a.m.	14·4° C.	35·32°/$_{oo}$	1½ hours ebb.	50° 23′ N. Lat. 0° 1′ W. Long.	5.11.03 0.40 a.m.	13·7° C.	35·41°/$_{oo}$	2¼ hours ebb.
50° 11′ N. Lat. 0° 3′ W. Long.	22.10.03 2.15 a.m.	14·7° C.	35·35°/$_{oo}$	2¾ hours ebb.	50° 11′ N. Lat. 0° 3′ W. Long.	5.11.03 1.15 a.m.	13·9° C.	35·41°/$_{oo}$	3½ hours ebb.
49° 59′ N. Lat. 0° 6′ W. Long.	22.10.03 3.20 a.m.	15·0° C.	35·22°/$_{oo}$	3¾ hours ebb.	49° 59′ N. Lat. 0° 7′ W. Long.	5.11.03 3.15 a.m.	13·9° C.	35·34°/$_{oo}$	4¾ hours ebb.
49° 47′ N. Lat. 0° 9′ W. Long.	22.10.03 5.10 a.m.	15·0° C.	34·71°/$_{oo}$	Ebb nearly done.	49° 47′ N. Lat. 0° 10′ W. Long.	5.11.03 4.35 a.m.	13·9° C.	34·92°/$_{oo}$	Slack.

NEWHAVEN--CAEN LINE—*continued.*

November 18th and 19th, 1903. S.S. *Calvados.*—F. Banks, Master.					December 2nd and 3rd, 1903. S.S. *Calvados.*—F. Banks, Master.				
50° 35′ N. Lat. 0° 2′ E. Long.	18.11.03 11.45 p.m.	12·2° C.	35·30°/$_{oo}$	1¼ hours ebb.	50° 35′ N. Lat. 0° 2′ E. Long.	2.12.03 10.45 p.m.	10·3° C.	35·13°/$_{oo}$	1½ hours ebb.
—	—	—	—	—	50° 23′ N. Lat. 0° 0′ E. Long.	2–3.12.03 midnight.	10·6° C.	—	2¾ hours ebb.
50° 11′ N. Lat. 0° 3′ W. Long.	19.11.03 2.5 a.m.	12·6° C.	35·47°/$_{oo}$	3½ hours ebb.	50° 11′ N. Lat. 0° 2′ W. Long.	3.12.03 1.15 a.m.	10·9° C.	35·47°/$_{oo}$	4 hours ebb.
49° 59′ N. Lat. 0° 6′ W. Long.	19.11.03 3.20 a.m.	12·2° C.	35·40°/$_{oo}$	5 hours ebb.	49° 59′ N. Lat. 0° 5′ W. Long.	3.12.03 2.30 a.m.	10·6° C.	35·41°/$_{oo}$	5¼ hours ebb.
49° 47′ N. Lat. 0° 8′ W. Long.	19.11.03 4.35 a.m.	12·2° C.	34·99°/$_{oo}$	Slack.	49° 47′ N. Lat. 0° 7′ W. Long.	3.12.03 3·45 a.m.	9·4° C.	33·40°/$_{oo}$	½ hour flood.

December 17th and 18th, 1903. S.S. *Calvados.*—F. Banks, Master.					December 30th and 31st, 1903. S.S. *Trouville.*—E. G. Phillips, Master.				
50° 35′ N. Lat. 0° 2′ E. Long.	17.12.03 11 20 p.m.	10·0° C.	35·32°/$_{oo}$	1¼ hours ebb.	50° 35′ N. Lat. 0° 3′ E. Long.	30.12.03 9.15 p.m.	8·6° C.	35 32°/$_{oo}$	1½ hours ebb.
50° 23′ N. Lat. 0° 0′ E. Long.	18.12.03 0.35 a.m.	10·6° C.	35·39°/$_{oo}$	2½ hours ebb.	50° 23′ N. Lat. 0° 3′ E. Long.	30.12.03 10.30 p.m.	8·9° C.	35·38°/$_{oo}$	3 hours ebb.
50° 11′ N. Lat. 0° 2′ W. Long.	18.12.03 1.45 a.m.	10·6° C.	35·36°/$_{oo}$	3½ hours ebb.	50° 11′ N. Lat. 0° 3′ E. Long.	30.12.03 11.45 p.m.	8·9° C.	35·38°/$_{oo}$	4 hours ebb.
49° 59′ N. Lat. 0° 5′ W. Long.	18.12.03 3 a.m.	10·0° C.	35·14°/$_{oo}$	5 hours ebb.	49° 59′ N. Lat. 0° 3′ E. Long.	31.12.03 1.15 a.m.	7·0° C.	34·05°/$_{oo}$	5½ hours ebb.
49° 47′ N. Lat. 0° 7′ W. Long.	18.12.03 4.30 a.m.	9·8° C.	35·10°/$_{oo}$	Slack.	49° 46′ N. Lat. 0° 2′ E. Long.	31.12.03 2.35 a.m.	6·1° C.	33·52°/$_{oo}$	1 hour flood.

It will be seen that on October 21st the highest salinity was 35·35°/$_{oo}$. During the two following fortnights it rose to 35·41°/$_{oo}$ and 35·47°/$_{oo}$ in the centre of the Channel; the latter value was maintained to December 2nd, but during the rest of the month it fell to 35·38°/$_{oo}$. The last column of the Table shows the approximate state of the tide at the time when the sample was taken. There is no very marked connection between the salinity and the tide, but on the whole, over the centre line of the Channel, the salinity increases with the number of hours that the ebb has been running. The lowest salinity under the French coast is found on the flood tide, when the fresh water of the Seine is flowing to the north and east.

The origin of this patch of salt water is doubtful: no connection with the denser water of the western part of the Channel has been found, either on the surface or as an undercurrent; and it cannot be derived from the North Sea, as no water of such high salinity occurs there. The only point which may be considered as proved by the observations is that it changes its position in an east and west direction, and that therefore a number of samples must be collected on different lines to the east of Beachy Head before its absence at any given time can be established. A probable explanation of its origin is that at some time dense water has extended over the whole length of the Channel, and has since been divided into two district areas by a flood of fresher water from the Seine and Southampton water.

It is hoped to make some experiments on the proportion of chlorine to other constituents over this area during 1904.

VARIATION OF SEA TEMPERATURE DURING TWENTY-FOUR HOURS.

During the summer of 1903 the question of taking regular observations of temperature on light-ships was considered, and as there was considerable divergence of opinion as to the most suitable time

for such observations, two series of experiments were made, each series lasting twenty-four hours, and the observations were extended to all depths. The position chosen was station E. 1, ten miles S.W. $\frac{1}{4}$ W. westerly from the Eddystone, in 73 to 74 metres (40 fathoms) on a sandy bottom. Temperatures were observed every two hours at the surface, 5, 10, 15, 20, 30 metres, and at the bottom, the apparatus used being the Nansen-Pettersson water bottle. A number of plankton samples were also collected.

The first set of observations was made on the 1st and 2nd of July, and the second set on the 14th and 15th of July; in each case on board the Association's steamer *Oithona*. The value of the first set was somewhat doubtful, as the weather conditions were not quite normal, beginning with a hot sun and dead calm at mid-day on July 1st, and changing to a fresh breeze with a rough sea and overcast sky on the morning of July 2nd. During the last half of the time the vessel dragged her anchor for a considerable distance, but this probably did not affect the temperatures to any appreciable extent. The second set of observations, on the 14th and 15th of July, were carried out under more favourable conditions, the weather being practically unchanged during the twenty-four hours, with an overcast sky, slight sea, and S.W. wind of force 2 to 3 Beaufort.

The observations made are given in the following table; the time of beginning and ending each set is given at the head of each column.

TEMPERATURES ON STATION E. 1 DURING TWENTY-FOUR HOURS.

	1st July, 1903.							2nd July, 1903.						
—	12.15 p.m. to 1.15 p.m.	2.15 p.m. to 2.30 p.m.	3.7 p.m. to 3.40 p.m.	5.10 p.m. to 5.53 p.m.	7.20 p.m. to 7.54 p.m.	9.20 p.m. to 10.9 p.m.	11.15 p.m. to 11.50 p.m.	1 a.m.	2.15 a.m. to 3.57 a.m.	5.10 a.m. to 6 a.m.	6.55 a.m.	8.15 a.m. to 8.50 a.m.	11.12 a.m. to 11.55 a.m.	1.6 p.m.
Surface	14·67°	14·77°	15·61°	15·50°	15·02°	14·52°	14·13°	14·27°	14·07°	14·05°	14·08°	14·18°	14·37°	14·33°
5 m.	—	—	14·08°	13·45°	14·78°	14·19°	13·97°	—	13·93°	13·89°	—	13·90°	14·16°	—
10 m.	—	12·19°	12·82°	11·83°	13·11°	12·97°	13·25°	—	12·25°	12·85°	—	13·88°	13·51°	—
15 m.	—	—	11·96°	11·75°	12·05°	—	11·92°	—	11·89°	11·75°	—	11·96°	11·86°	—
20 m.	—	11·81°	11·85°	11·71°	11·89°	11·75°	—	—	11·64°	11·64°	—	11·77°	11·76°	—
30 m.	11·77°	—	11·79°	11·69°	11·83°	11·72°	11·66°	—	11·63°	11·64°	—	11·62°	11·73°	—
70 m.	11·75°	—	11·75°	11·64°	11·70°	11·67°	11·64°	—	11·63°	11·62°	—	11·61°	11·67°	—

	14th July, 1903.						15th July, 1903.					
—	12.15 p.m. to 1.13 p.m.	2.25 p.m. to 2.50 p.m.	4.15 p.m. to 4.41 p.m.	6.3 p.m. to 6.25 p.m.	8.7 p.m. to 8.33 p.m.	10 p.m. to 10.30 p.m.	0.5 a.m. to 0.30 a.m.	2.7 a.m. to 2.37 a.m.	6.5 a.m. to 6.28 a.m.	8.6 a.m. to 8.33 a.m.	10 a.m. to 10.20 a.m.	noon. to 12.24 p.m.
Surface	15·38°	15·37°	15·39°	15·28°	15·07°	15·01°	15·03°	14·99°	15·03°	15·08°	15·11°	15·43°
5 m.	15·07°	15·08°	15·04°	15·11°	14·97°	14·89°	14·99°	14·98°	14·89°	14·90°	14·87°	15·01°
10 m.	14·86°	14·79°	14·51°	14·96°	14·71°	14·73°	14·97°	14·91°	14·89°	14·89°	14·82°	14·91°
15 m.	14·49°	13·81°	13·07°	13·92°	14·23°	14·20°	14·41°	13·89°	13·99°	14·24°	14·80°	13·21°
17·5 m.	13·11°	13·90°	12·11°	12·23°	—	—	—	—	—	—	—	11·95°
20 m.	11·92°	12·04°	12·07°	12·12°	11·93°	11·96°	11·93°	11·94°	12·07°	11·99°	13·24°	11·92°
30 m.	11·87°	11·95°	12·04°	12·04°	11·87°	11·90°	11·89°	11·91°	12·03°	11·91°	11·90°	11·88°
70 m.	11·86°	11·91°	11·95°	11·97°	11·91°	11·87°	11·87°	11·89°	11·94°	11·89°	11·87°	11·88°

The results are shown graphically on Plate VII. The two lower diagrams show the actual variation in temperature at the surface, 5, 10, 15, 20, and 70 metres. The curve for 30 metres has been omitted for the sake of clearness; it does not differ appreciably from that for 70 metres. The two upper

diagrams show the variation in the position of the isotherms from hour to hour for single degrees centigrade; as the observations for each two hours could not be simultaneous, the isotherms have been drawn from smoothed curves and the variation in their position is thus, to a certain extent, less than is demanded by some of the temperatures recorded. Over each is shown the state of the tide, while the meteorological conditions are given between the diagrams

Both sets of observations show a maximum surface temperature between 2 p.m. and 4 p.m., combined with a minimum temperature at depths slightly below the surface, this minimum being strongly marked at 5, 10, and 15 metres in the first series, and at 10 and 15 metres in the second series; both series also show a minimum surface temperature from 2 a.m. to 4 a.m., associated with a marked drop in the temperatures in the first case at 10 metres, and in the second at 15 metres. The surface observations agree with the experience of the Meteorological Office, which has fixed on sunrise and 4 p.m. as the best time for taking temperatures from lightships. Apart from these points, the two sets show well marked differences, which can be more easily followed in the two upper diagrams showing the isotherms. On the first occasion there was little fall of temperature between 15 metres and the bottom, while the second only showed a constant temperature after 20 metres was reached, and even at this depth there was a sudden rise about 10 a.m. on July 15th.

On July 1st and 2nd the temperature gradient was fairly uniform and steep down to 15 metres, and from that point to the bottom very flat, and these conditions were maintained during the whole of the twenty-four hours. On July 14th and 15th, however, we find a moderate though somewhat irregular gradient from the surface to 15 metres, a steep gradient for the next two or three metres, and then a very irregular one, the isotherm for 12° C. dipping to 60 metres at 6 p.m., and to 45 metres at 6 a.m. next morning. These two points on the isotherm correspond to the first of the flood, and are faintly marked in the first set under the same tidal conditions. Unfortunately the time of high water was nearly the same during the two periods, and this makes it somewhat difficult to separate the tidal influence from that due to the height of the sun. The general conclusions to be drawn from the experiments are:—

I. That, during the summer at least, only very slight weight can be given to surface temperature observations over a large area, unless they are taken simultaneously, and under the same meteorological conditions, which is practically impossible, and therefore that a surface temperature chart of a large area, compiled from observations taken in hot weather during a cruise lasting some days, and at various times during the twenty-four hours can only give a very rough approximation to the truth.

II. That the most suitable times for observations from lightships are sunrise and 4 p.m., as has been previously pointed out by the Meteorological Office.

Experiments made on methods of observing surface temperature from a ship at anchor show that many precautions are necessary during or after a period of hot sun. The following observations will give some idea of the number of errors that may creep in. On July 1st about 1.50 p.m., the sea being dead calm with no wind, and a bright sun, the Nansen-Pettersson water bottle was slung out from the boom on the sunny side of the ship and allowed to hang there for half-an-hour with the thermometer bulb about 15 c.m. (6 inches) below the surface. It was then closed and hauled in, and the temperature shown was 14·88° C. A temperature taken on the same side of the ship with a leather bucket was also 14·88° C., while temperatures taken in the shade of the vessel varied from 14·3° C. near the stern to 14·7° C. in the shade of the bowsprit about a foot from the stem. It would appear that this last is the most nearly correct, as the water had not been in contact with the ship; and that on the sunny side the water is heated by radiation and conduction from the ship's side, while in the shade it cools fairly rapidly. Of course these errors decrease as the strength of the tide increases.

SUMMARY.

Previous observations in the Channel are somewhat scanty, and as the meteorological conditions during the past year have not been normal, no attempt to compare the results obtained with those of other investigations has been made in this report, which is not intended to do more than to give an account of the work actually done and to advance a tentative hypothesis to explain the facts recorded. It is hoped in the course of the present year to prepare a report which will bring together all that has been done by others in the Channel and regions to the west of it.

On examining the charts, it will be found that on all four cruises the highest salinity was recorded near Ushant, or on station E. 4 about sixty miles to the west ; and that this water, more or less diluted, but still recognisable, sometimes on the surface, at others as an undercurrent, stretches northwards towards Land's End, and eastwards past Start Point towards the Isle of Wight ; while on the west it was always bounded by fresher water, the dividing line running approximately north and south. The chart for the Bay of Biscay shows that this line, in November, curves round again towards the south of Ireland, and the isohalines give strong evidence of a southward flow of fresher water from the Irish Sea. It seems certain that the low salinity water lying across the Channel fairway was derived from this source on all occasions when it was observed, and we are therefore driven to the conclusion that, during 1903, at any rate, the physical conditions in the Channel have depended on the relative strength of three currents, one flowing in a southward direction from the Irish Sea, another in an eastward direction into the English and Bristol Channels, and a third setting in a northward direction from some point near Ushant. This latter coincides with what has long been known under the name of Rennell's current. The Admiralty Channel Pilot, ninth edition, 1900, has the following remarks :—" . . . . the currents of these seas are merely the prolonged movement of the water resulting from recent and possibly remote gales. . . . . After south-west or westerly gales, a current setting towards the Irish and English Channels may be expected, the rate depending upon the strength and continuance of the bad weather, and the distance off of the disturbance. When, however, strong or long-continued westerly winds have prevailed westward of the north coast of Spain, an outset from the Bay of Biscay may take place from the Chaussée de Sein, which flows obliquely across the fairway to the English Channel, and has received the name of Rennell's current ; this may sweep a vessel towards or northward of the Scilly Isles. The Rennell current does not appear to be frequently experienced to any great extent, but it may attain a rate of one to one-and-a-half knots an hour."

On this assumption, the physical conditions in the English Channel are fairly easy to explain.

In February, Rennell's current was sufficiently strong to drive water from near Ushant, diluted to 35·4°/$_{oo}$ S., well westward of Land's End into the Bristol Channel, while this same water extended eastwards nearly to the Isle of Wight, crowding the lines of lower salinity together under the shore, and thus indicating that the water was either in quick movement or had recently been so, and that therefore there had not been sufficient time for the littoral waters to mix with those of the main Channel stream.

In the interval between the February and May cruises, the eastward Atlantic current had driven the waters of the Irish sea further into the Channel, so that the line dividing the water of 35·3°/$_{oo}$ S. from that of 35·4°/$_{oo}$ S. now nearly touched Land's End, while what appears from the chart for May to be an increase in the strength of the northward current may be due to the fact that owing to want of data the high salinity area near Ushant in February has not been traced as far north as it really extended. The eastern boundary of the 35·4°/$_{oo}$ S. water has retreated westward, and fined away to a point, while

the isohalines surrounding it are further apart, showing slow movement of the waters and considerable consequent mixture. In this month the high salinity region in the eastern part of the Channel was first observed.

In August the observations show that the Rennell's current has ceased to have any appreciable influence on the movements of the water in the English Channel, while the inflow of low salinity water has so far increased that it has covered the surface of the entrance, leaving only an underwater connection between the Bay of Biscay and the 35·4°/$_{oo}$ S. water of the Channel proper. The water of highest salinity is now no longer found at station E. 3, in the direct path of the Rennell's current, but at station E. 4. To the eastward, we find that the 35·4°/$_{oo}$ S. area has still further decreased, and that the distance between the isohalines points to almost complete stagnation.

In November, water of 35·4°/$_{oo}$ S. had again appeared on the surface at stations E. 4 and E. 5, pointing possibly to a slight increase in the strength of the Rennell current. The western entrance is still filled with water of 35·3°/$_{oo}$ S., which has advanced eastwards, driving the denser water bodily before it, and again crowding the isohalines together to a noticeable extent. Whether this is a preliminary to a return to February conditions cannot be settled until the material collected this year has been worked out.

The surface temperature depends so largely on meteorological conditions at the time of taking the observations that it throws little light on the movements of the water. The bottom temperature on the other hand changes slowly, and varies only slightly in the course of the twenty-four hours ; but the number of observations is much smaller, and it is scarcely possible to draw any very definite conclusions from one year's work. We find, however, that the seasonal temperature changes at the bottom agree fairly well with the variations of salinity. The temperature and salinity do not, however, always vary directly as one another ; in fact the exact converse holds in August, the shallow waters under the English coast, where the salinity is lowest, being heated by the sun much more quickly than the deeper waters of mid-Channel. In February and May the bottom isotherms follow the isohalines fairly closely, the temperature being highest west of Ushant and decreasing to a minimum in the littoral waters between Portland and Beachy Head. In August the conditions are reversed ; the isotherms at the western entrance to the Channel now run fairly straight in a north and south direction, and the temperature rises from 10° C., south of the Scillies, to 13° C. on a line from Plymouth to Ushant, and to 16° C. in the littoral waters south of the Isle of Wight. The observations of temperature and salinity agree in pointing to an inflow of water in an eastward direction from the Irish sea rather than to a northward and north-eastward current from the Bay of Biscay. In November there is a return to a temperature distribution resembling that of February and May, and the warm water again stretches up Channel from Ushant in a broad tongue, while the littoral waters of the south coast of England are once more the coldest. An interesting observation during this month was the presence of an axis of warm water in mid-Channel between the Channel Islands and the Baie de la Seine, the temperature of which was higher than anywhere else in the region investigated.

To briefly summarise the year's work : it would appear that in February and May the waters of the English Channel were derived chiefly from the Bay of Biscay, in August from the Irish Sea, and in November from both sources.

In conclusion, I wish to express my thanks to Dr. H. R. Mill, and to Commander M. W. Campbell Hepworth, C.B., R.N.R., for much valuable assistance and advice.

International Investigations Mar. Biol. Assoc., Report I.

Bristol Channel
South Foreland
Dungeness
Newhaven
Beachy Hd.
Selsea Bill
I. of Wight
St Catherines Pt.
Anvil Pt.
St.Albans Head
Portland
Plymouth
Start Point
Eddystone.
Lands End
The Lizard
Scilly Is.
Cape La Hague
Cape Barfleur
Casquets
Alderney
Guernsey
Sark
Jersey
Caen
Ushant (Ouessant)
Bottom Salinity 35·5
E.1⊕ E.2⊕ E.3⊕ E.4⊕ E.5⊕ E.6⊕ E.7⊕ E.8⊕ E.9⊕ E.10⊕ E.11⊕ E.12⊕ E.13⊕ E.14⊕ E.15⊕ E.16⊕ E.17⊕ E.18⊕ E.19⊕ E.20⊕ E.21⊕ E.22⊕
35·2 35·3 35·4 35·5

FEBRUARY, 1903.
Surface Salinities and Temperatures.

Surface Isohalines - - ———
Surface Temperatures - - - - - -
Bottom Isohalines - - — — —
Stations thus - - E.1.⊕.
Surface observations thus - +

Salinities are given to the first place of decimals: 35·4 on an area means that the whole of the water of the area is between 35·40 and 35·50 salinity.

Matthews. Physical Conditions.

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The Lizard
Scilly Is.
Casquets
Alderney
Cape La Hague
Cape Barfleur
Guernsey
Sark
Jersey
Caen
Ushant (Ouessant)

E.6⊕ E.7⊕ E.1⊕ E.20⊕ E.18⊕ E.16⊕ E.15⊕ E.14⊕ E.17⊕ E.19⊕ E.11⊕ E.13⊕ E.21⊕ E.22⊕ E.12⊕ E.10⊕ E.9⊕ E.8⊕ E.2⊕ E.5⊕ E.3⊕ E.4⊕

35·2 35·3 35·45 35·3 35·0 35·1 35·2 35·3 35·4 35·2 35·1 35·0 34 TO 35 33 TO 34 35·4 35·3 35·5 35·6 33

9° TO 10° 10° 10° TO 11° 11°

MAY, 1903.

Surface Salinities and Temperatures.

Surface Isohalines - - ———

Surface Temperatures - - – – – –

Stations thus - - E.1.⊕.

Surface observations thus - +

Salinities are given to the first place of decimals: 35·4 on an area means that the whole of the water of the area is between 35·40 and 35·50 salinity.

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Lands End
The Lizard
Scilly Is.
Alderney
Casquets
Cape La Hague
Cape Barfleur
Guernsey
Sark
Jersey
Caen
Ushant (Ouessant)

E.1.⊕ E.2.⊕ E.3.⊕ E.4.⊕ E.5.⊕ E.6.⊕ E.7.⊕ E.8.⊕ E.9.⊕ E.10.⊕ E.11.⊕ E.12.⊕ E.13.⊕ E.14.⊕ E.15.⊕ E.16.⊕ E.17.⊕ E.18.⊕ E.19.⊕ E.20.⊕ E.21.⊕ E.22.⊕

35·0 35·1 35·2 35·3 35·4 34 TO 35

Bottom Salinity 35·40 Bottom Salinity 35·40 Bottom Salinity 35·5

15° 16° 14° TO 15°

August, 1903.

Surface Salinities and Temperatures.

Surface Isohalines - - ———
Surface Isotherms - - - - - -
Bottom Isohalines - - — — —
Stations thus - - E.1.⊕
Surface observations thus - +

Salinities are given to the first place of decimals: 35·4 on an area means that the whole of the water of the area is between 35·40 and 35·50 salinity.

Matthews. Physical Conditions.

Printed at the Ordnance Survey Office, Southampton. 1904

International Investigations Mar. Biol. Assoc., Report I.

Bristol Channel

South Foreland

Dungeness

Newhaven

Beachy Hd.

Selsea Bill

I. of Wight

34 TO 35

St. Catherines Pt.

Anvil Pt.

Portland

St. Albans Head

E.14.⊕

E.22.⊕

12° TO 13°

E.15.⊕ 35·1

E.13.⊕ 35·2

35·4

35·45

E.21.⊕

12° TO 13°

E.16.⊕

E.18.⊕

Plymouth

Start Point

E.6.⊕

35·1

Eddystone

E.20.⊕

E.17.⊕

E.11.⊕

35·3

35·4

Lands End

The Lizard

35·2

E.1.⊕

Scilly Is.

E.19.⊕

E.12.⊕

E.7.⊕

E.10.⊕

Casquets

Alderney

Cape La Hague

Cape Barfleur

35·4

E.9.⊕

Guernsey

Sark

35·2

35·3

E.2.⊕

E.8.⊕

Jersey

Caen

E.5.⊕

E.4.⊕

E.3.⊕

35·4

Ushant (Quessant)

NOVEMBER, 1903.

Surface Salinities and Temperatures.

Surface Isohalines - - ————

Surface Temperatures - - - - - -

Stations thus - - E.1.⊕

Surface observations thus - +

Salinities are given to the first place of decimals: 35·4 on an area means that the whole of the water of the area is between 35·40 and 35·50 salinity.

PRINTED AT THE ORDNANCE SURVEY OFFICE, SOUTHAMPTON, 1904.

International Investigations Mar. Biol. Assoc., Report I.

10° 5° 0°

50° 45° 40°

Cork Harbour
Fastnet
St. George's Channel
Bristol Channel
Lands End
Start Pt.
Lizard Pt.
English Channel
Ushant
Bay of Biscay
Cape Finisterre

35·1
35·2
35·3
35·4
35·5
35·6
35·7
+35·81
35·93
36·02
+36·06

Surface Isohalines

November 1903.

Surface observations thus - +

Salinities of areas are given to the first place of decimals: 35·4 on an area means that the whole of the water of the area is between 35·40 *and* 35·50 *salinity.*

Where there are not enough observations for drawing the isohalines, the salinities of the samples are inserted thus + 35·81

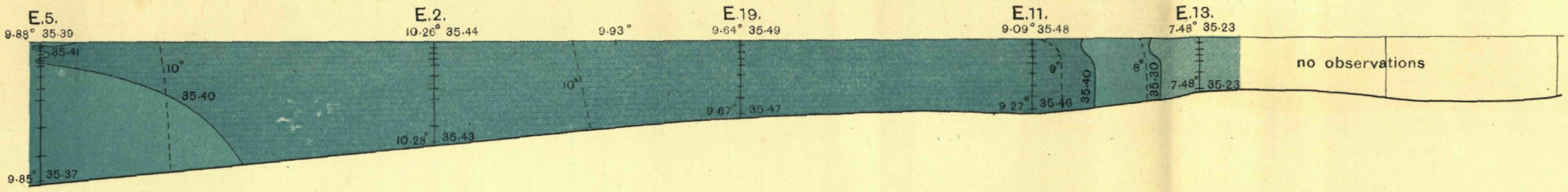
Matthews. Physical Conditions.

Printed at the Ordnance Survey Office, Southampton, 1904.

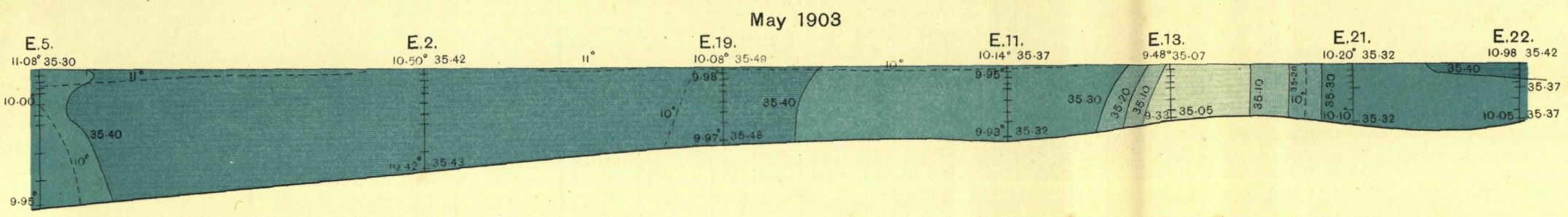
English Channel 1903.

International Investigations Mar. Biol. Assoc., Report I.

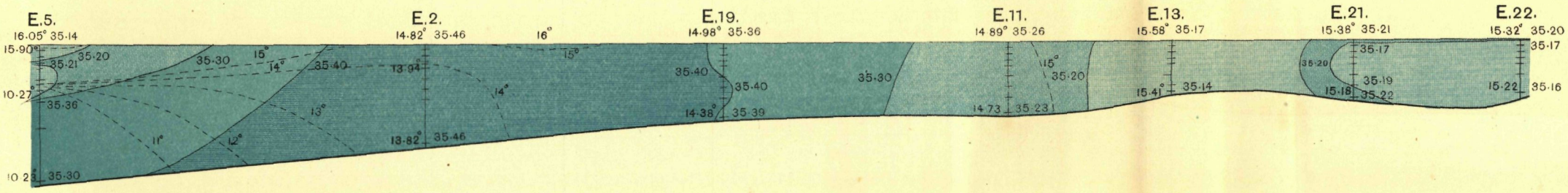
February 1903



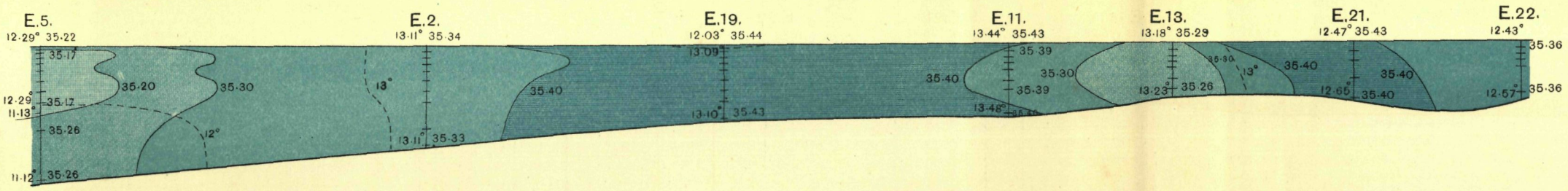
May 1903



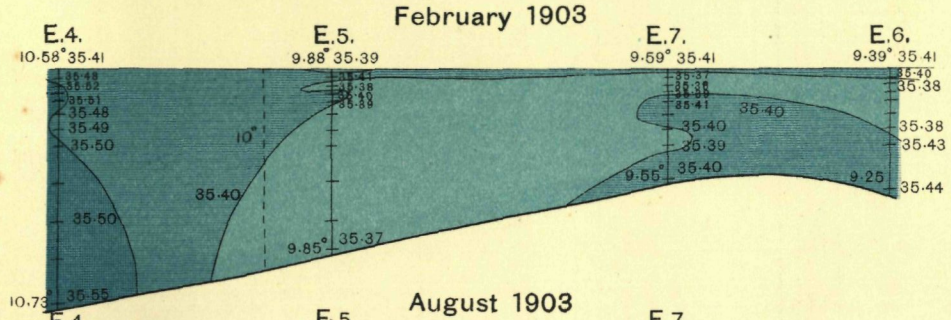
August 1903



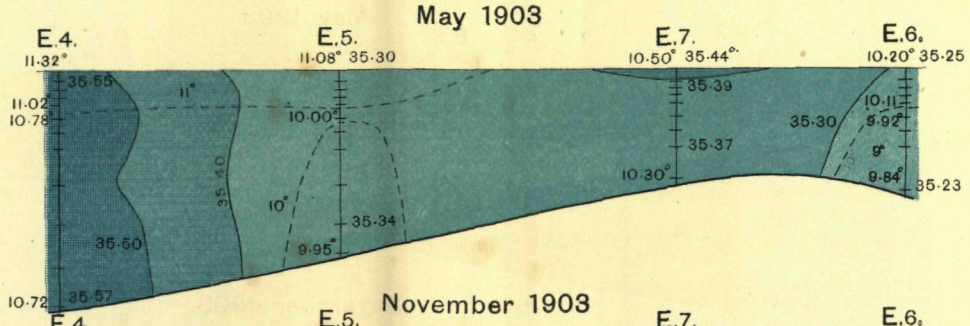
November 1903



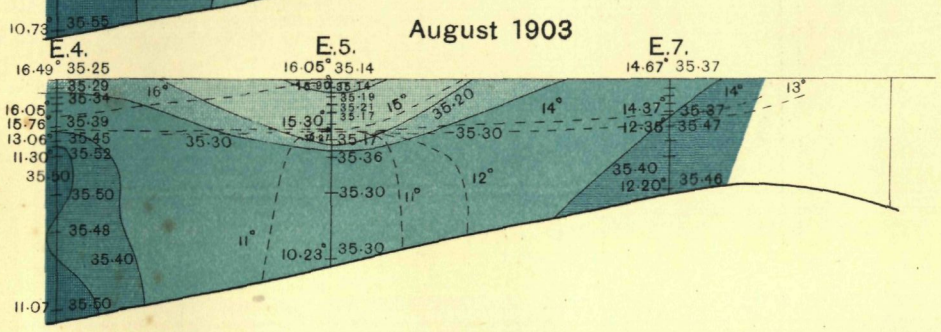
February 1903



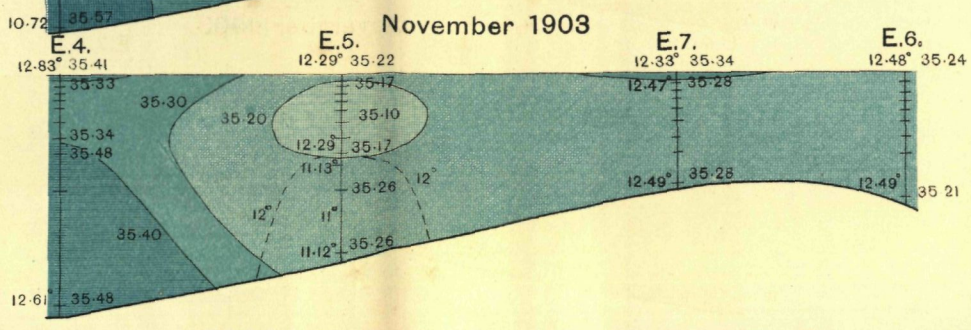
May 1903



August 1903



November 1903



Fathoms. Metres.

0 0
10 25
20 50
30 75
40 100
50 150
100 200

1 mm. rep. 5 Metres: 1: 5000

The unbroken lines are isohalines, the broken lines isotherms.

A horizontal line to the left of a vertical line at a station marks a temperature observation: to the right, a salinity determination

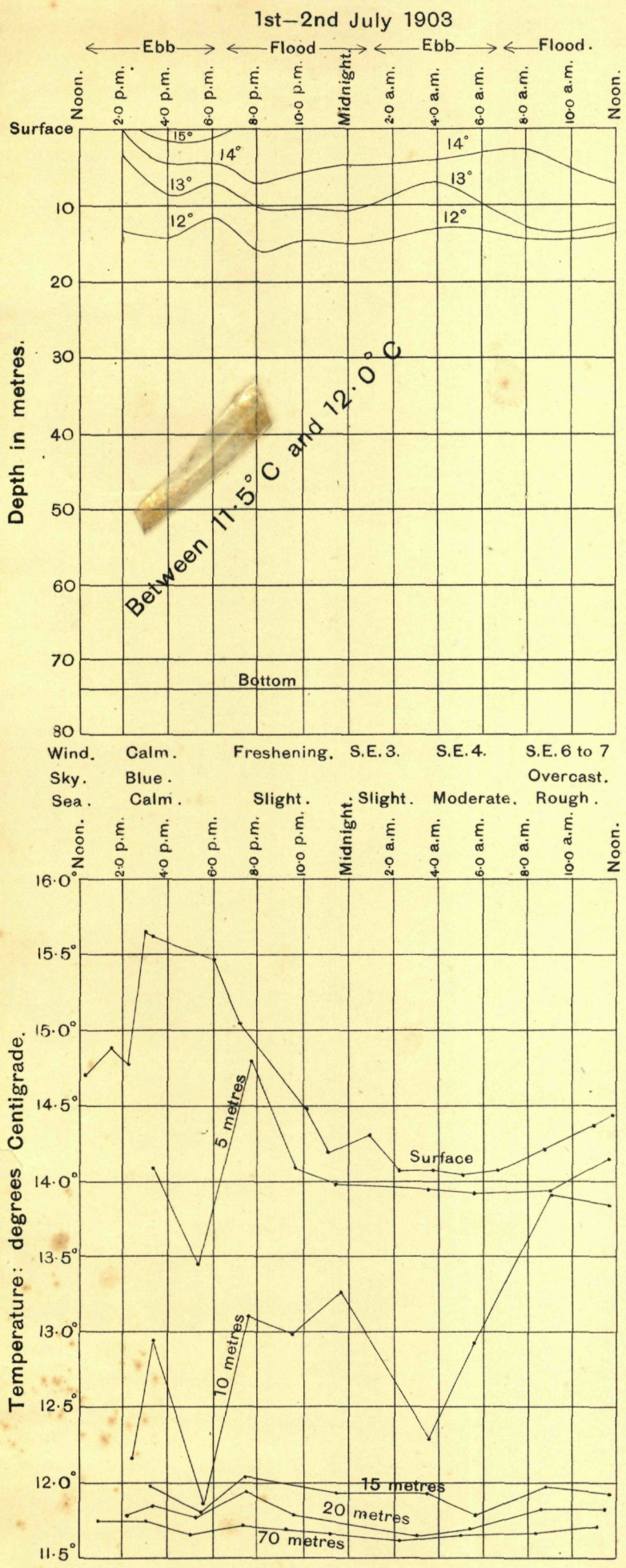
50 40 30 20 10 0 50 100 150 200 Kilometres.
10 0 10 20 30 40 50 60 70 80 90 100 Naut. miles.

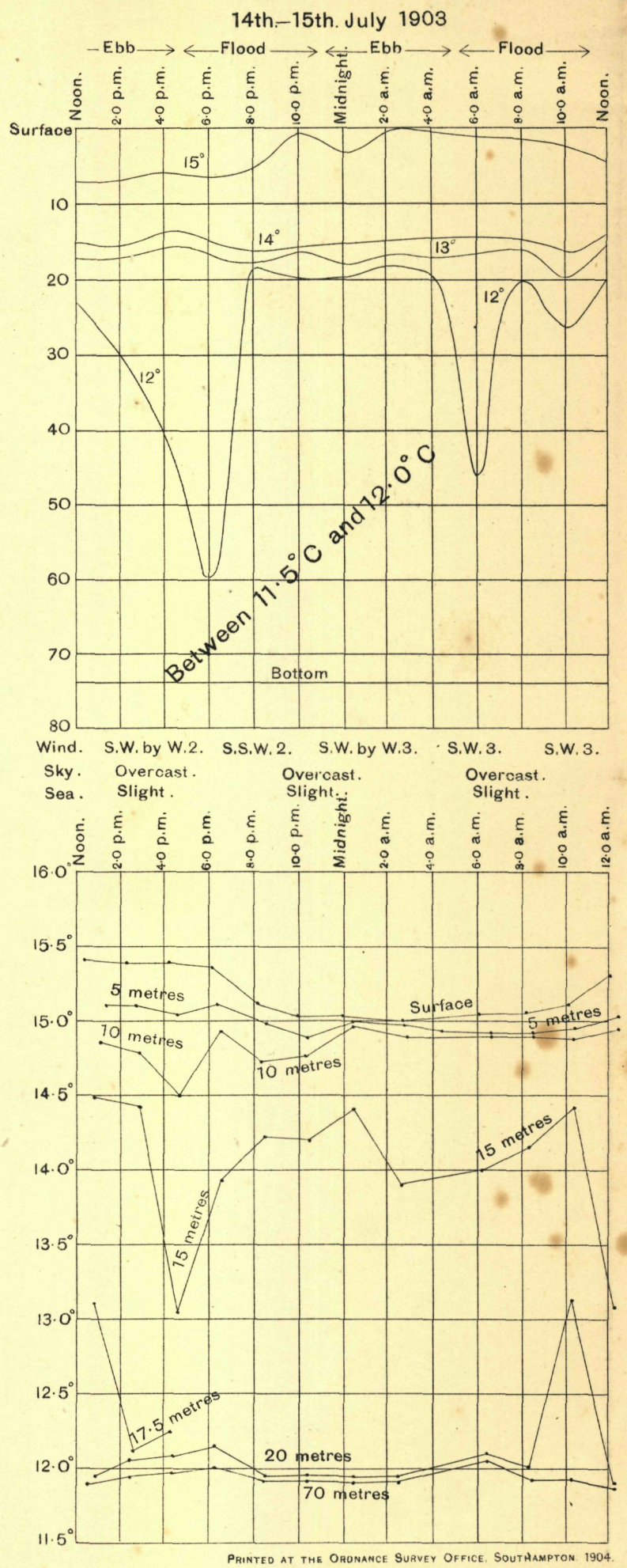
1 mm. rep. 2 Kilometres. 1: 2000000.

PRINTED AT THE ORDNANCE SURVEY OFFICE, SOUTHAMPTON. 1904.

Variation of temperature during twentyfour hours.

Station E.1. 50° 02′ N. Lat: 4° 22′ W. Long.





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Matthews. Physical Conditions.

Printed at the Ordnance Survey Office, Southampton. 1904.