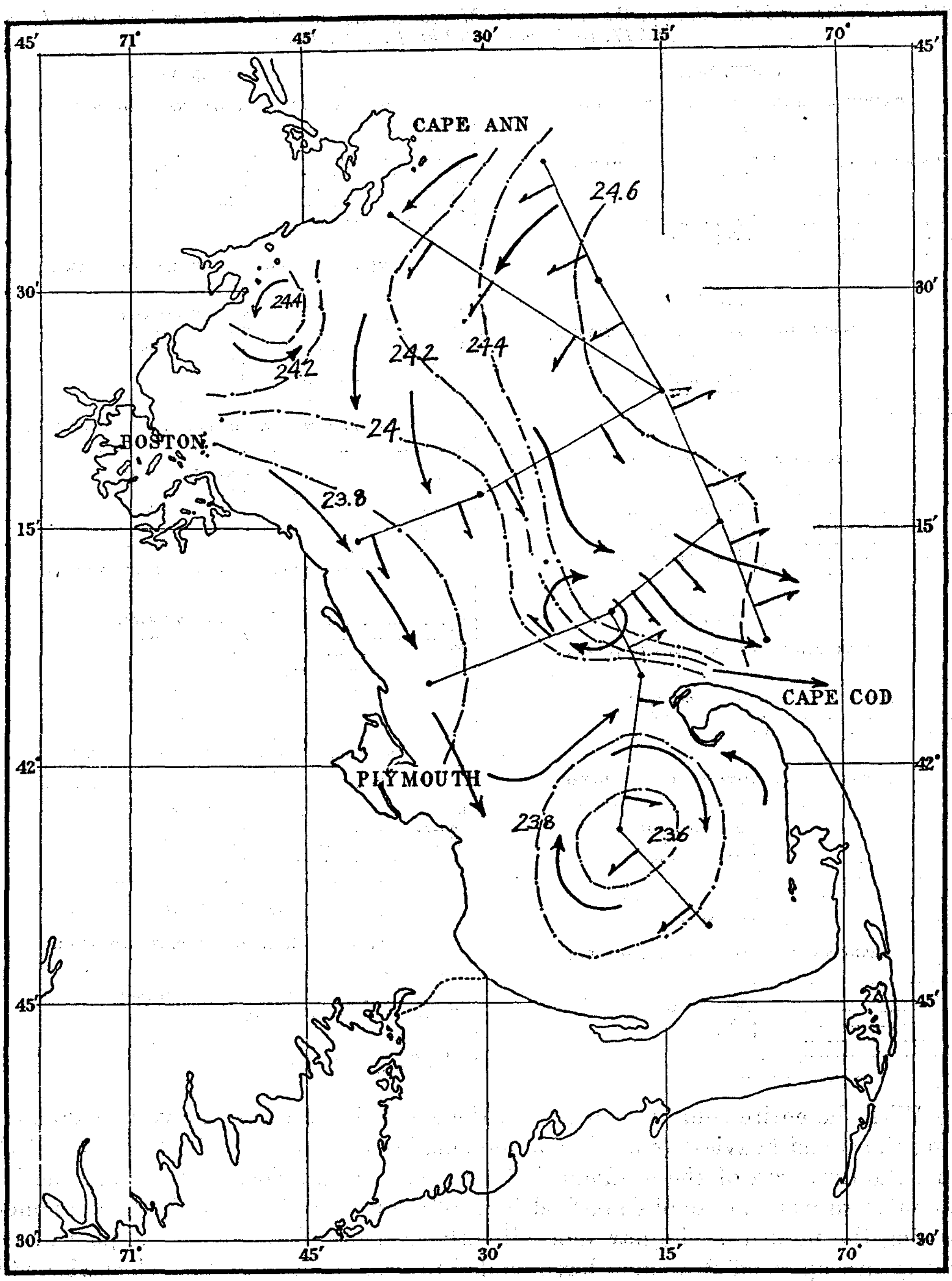

FIG. 199.—The single-barbed arrows show the direction of the gradient current, as calculated for Massachusetts Bay by R. Parmenter, June 16 and 17, 1925. The double-barbed arrows outline the nontidal circulation as it probably existed at the time. The broken curves give the density at the surface. For further explanation see p. 952

Relative velocities and directions of the currents in Massachusetts Bay, "Fish Hawk" stations, June 16 and 17, 1925, calculated by R. Parmenter

SECTION I

STATIONS 35 TO 32. DISTANCE, 37 KILOMETERS

Depth, meters	Velocity (cm. sec.)	Direction
0	5.16	Southwest.
10	3.43	Do.
20	(1)	

SECTION II

STATIONS 16 TO 18A. DISTANCE, 15 KILOMETERS

Depth, meters	Velocity (cm. sec.)	Direction
0	5.67	Southeast.
10	4.24	Do.
26	(1)	

STATIONS 18A TO 32. DISTANCE, 24 KILOMETERS

Depth, meters	Velocity (cm. sec.)	Direction
0	7.74	Southeast.
10	3.91	Do.
20	.63	Do.
40	.76	Northwest.
50	(1)	

SECTION III

STATIONS 14 TO 3. DISTANCE, 24 KILOMETERS

Depth, meters	Velocity (cm. sec.)	Direction
0	0.08 (2)	Northwest.
10	1.40	Do
22	(1)	

STATIONS 3 TO 33. DISTANCE, 16 KILOMETERS

Depth, meters	Velocity (cm. sec.)	Direction
0	8.22	Southeast.
10	8.03	Do.
20	4.28	Do.
30	(1)	

SECTION IV

STATIONS 3 TO 4. DISTANCE, 8 KILOMETERS

Depth, meters	Velocity (cm. sec.)	Direction
0	1.92	Northeast.
10	4.98	Southwest.
20	4.47	Do
30	(1)	

SECTION V

STATIONS 30 to 31. DISTANCE, 15 KILOMETERS

Depth, meters	Velocity (cm. sec.)	Direction
0	6.94	Southwest.
10	4.18	Do.
20	1.62	Do.
40	.13	Do.
75	(1)	

STATIONS 31 to 32. DISTANCE, 15 KILOMETERS

Depth, meters	Velocity (cm. sec.)	Direction
0	2.09	Southwest.
10	2.79	Do.
20	2.29	Do.
40	0.00	
50	(1)	

STATIONS 32 to 33. DISTANCE, 16 KILOMETERS

Depth, meters	Velocity (cm. sec.)	Direction
0	6.33	Northeast.
10	4.69	Do.
20	2.41	Do.
50	(1)	

STATIONS 33 to 34. DISTANCE, 15 KILOMETERS

Depth, meters	Velocity (cm. sec.)	Direction
0	1.63	Northeast.
10	2.51	Do.
20	2.31	Do.
50	(1)	

SECTION VI

STATIONS 4 to 6A. DISTANCE, 18 KILOMETERS

Depth, meters	Velocity (cm. sec.)	Direction
0	7.77	East.
10	5.74	Do.
20	3.52	Do.
34	(1)	

SECTION VII

STATIONS 6A to 7. DISTANCE, 16 KILOMETERS

Depth, meters	Velocity (cm. sec.)	Direction
0	1.47	Southwest
10	(1)	

[1] Assumed stationary.
[2] Negligible.

With the entire column of water on the whole lightest (specific volume greatest) along shore and heaviest (specific volume smallest) off the mouth of the bay at the time, the direction of the gradient drift was clearly anticlockwise around the bay and outward past the tip of Cape Cod (fig. 199), but also with a southerly component crossing the mouth of the bay more directly from north to south. A pool of low density in Cape Cod Bay must have tended to produce a subsidiary clockwise eddy occupying most of the area between the Plymouth shore and Cape Cod.

The calculated directions and velocities also show a second but smaller eddy of the same sort centering over the southwestern edge of Stellwagen Bank, though this would not appear from the distribution of density at the surface.

Dynamic evidence thus suggests the persistence of the general southerly drift past this sector of the coast line through June, involving Massachusetts Bay, which is corroborated by the drifts of a considerable number of bottles that were put out in the bay by the *Fish Hawk* a month earlier.

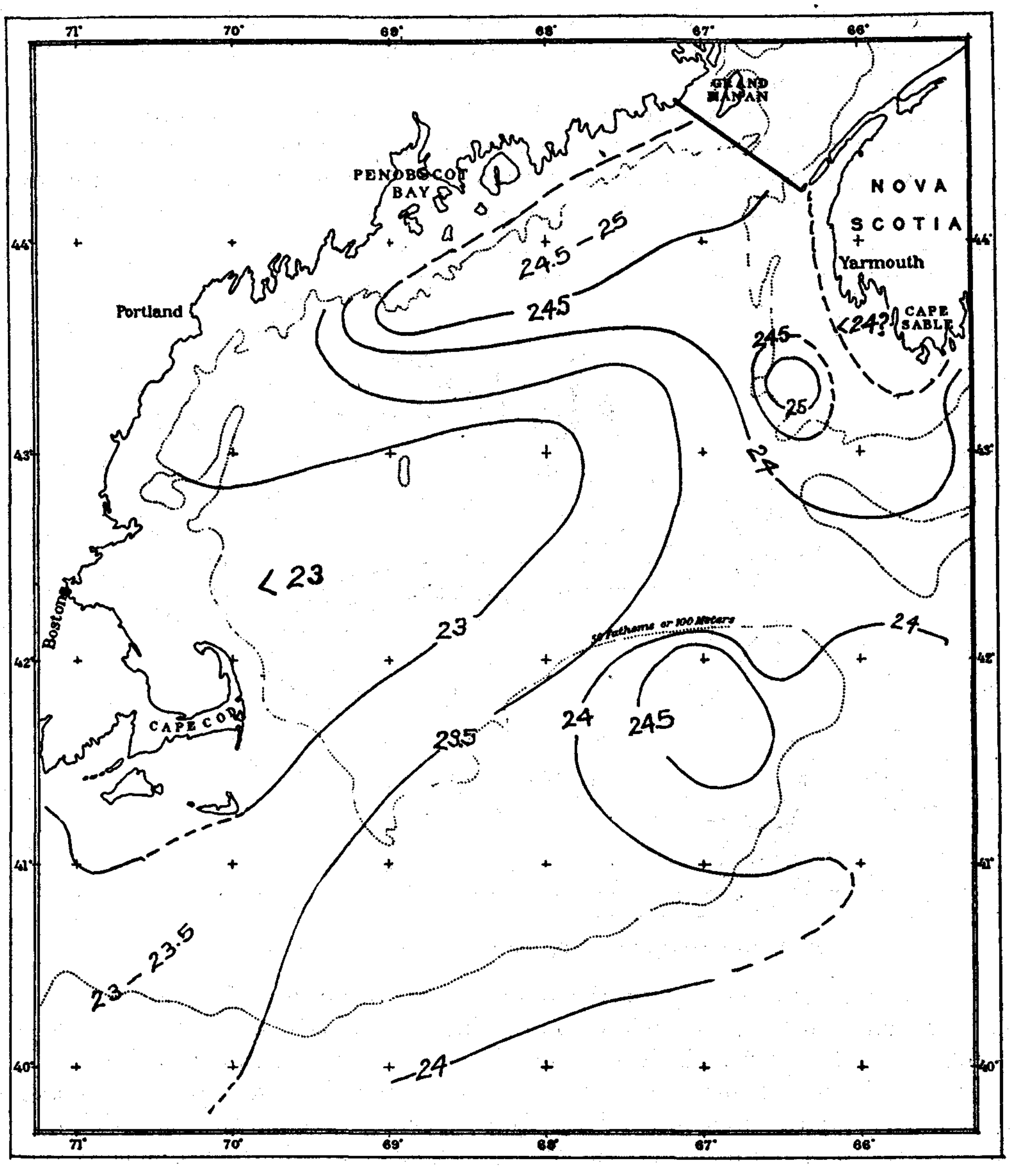

FIG. 200.—Distribution of density at the surface of the gulf, July and August, 1914

JULY AND AUGUST

The rapid solar warming of the surface over the western arm of the basin leads to the development of a pool of low density in the offing of Cape Ann by July and August (figs. 200 and 201). The eastern part of the gulf, on the other hand, continues high in surface density throughout the summer, because of the strong tidal currents that constantly mix the surface stratum, as it warms, with colder and more saline water from below (p. 928), and because the indraft of slope water of high salinity is directed into this side of the gulf. Consequently, the regional variation in the density of the upper 40 meters is wider in summer than at any other season, with the fundamental west-east gradation reappearing from year to year in essentially the same spacial relationship.

In April, and especially in May, the reader will recall, simple projection of the density contours at the surface mirrors the general dynamic tendency for the whole body of water in the gulf, regional distribution being essentially similar downward through the whole column. This, however, is not the case in summer, because the

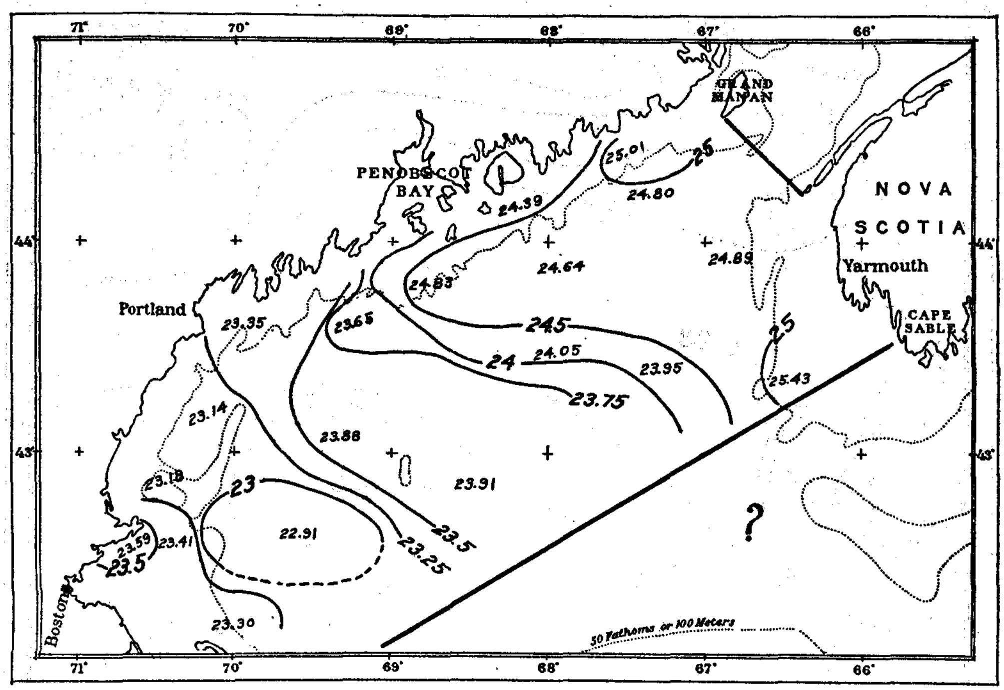

FIG. 201.—Distribution of density at the surface, for the inner part of the gulf, August, 1913

surface pool of low density in the offing of Massachusetts Bay is a superficial phenomenon. In fact, the surface contour lines run almost at right angles to those at 100 meters (fig. 202), which more nearly preserve the character of the preceding months. The actual surface drift in this side of the gulf is therefore the component of a rather complex screwing motion. In the northeastern part of the gulf, however, the surface state more nearly mirrors the regional distribution of density for the whole column.

Unfortunately no one of our summer cruises has afforded the data needed for a satisfactory mapping of density for the whole area. In the only summer (1914) when the southeastern part of the area was surveyed, the coastal belt (more important dynamically) was neglected. In every case, too, allowance must be made for possible errors caused by the considerable period of time over which each survey extended. The rapidity with which the density of the upper stratum may be increased, if the surface be chilled by vertical circulation of any kind, makes it unsafe ever to lay any stress on small regional differences where tidal currents cause as much overturning of the water as they do in parts of the Gulf of Maine.

The accompanying dynamic chart for the summer of 1914 (fig. 203) shows the dynamic tendency toward circulation at the surface of the inner parts of the gulf and of the waters off Marthas Vineyard for August and of the Georges Bank-Browns Bank region for that July. Unfortunately, these two divisions of the picture are not strictly comparable because solar warming had been responsible for

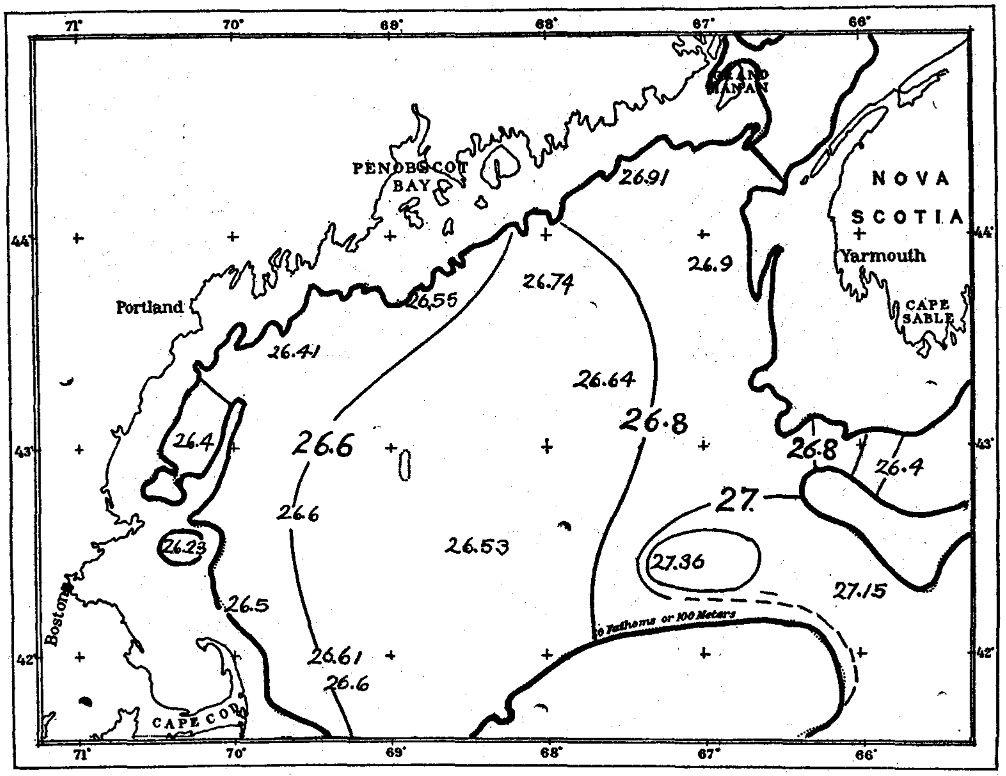

FIG. 202.—Density at 100 meters, July to August, 1914. Corrected for compression

some slight decrease in the density of the surface stratum from the one month to the next, and for a very considerable decrease close to Cape Sable, where stations situated close together but occupied 17 days apart differed by 0.4 in density. Nevertheless, the general dynamic gradient proved so consistent for the gulf as a whole for the two months that it has seemed justifiable to neglect the time interval in drawing the contour lines; the more so since the heaviest centers for July and August proved almost exactly equal in dynamic height.

If the chart, so combined, be indeed typical of the season (as seems likely from general knowledge of the temperature and salinity of the region), two centers of high density (indicated as "low" on the dynamic chart) are now to be expected—the one overlying Browns Bank, the Eastern Channel, and the water off the mouth of the latter; the other situated over the northeastern part of the basin; the two separated by a slight potential elevation of the surface. Contrasting with these "lows," which

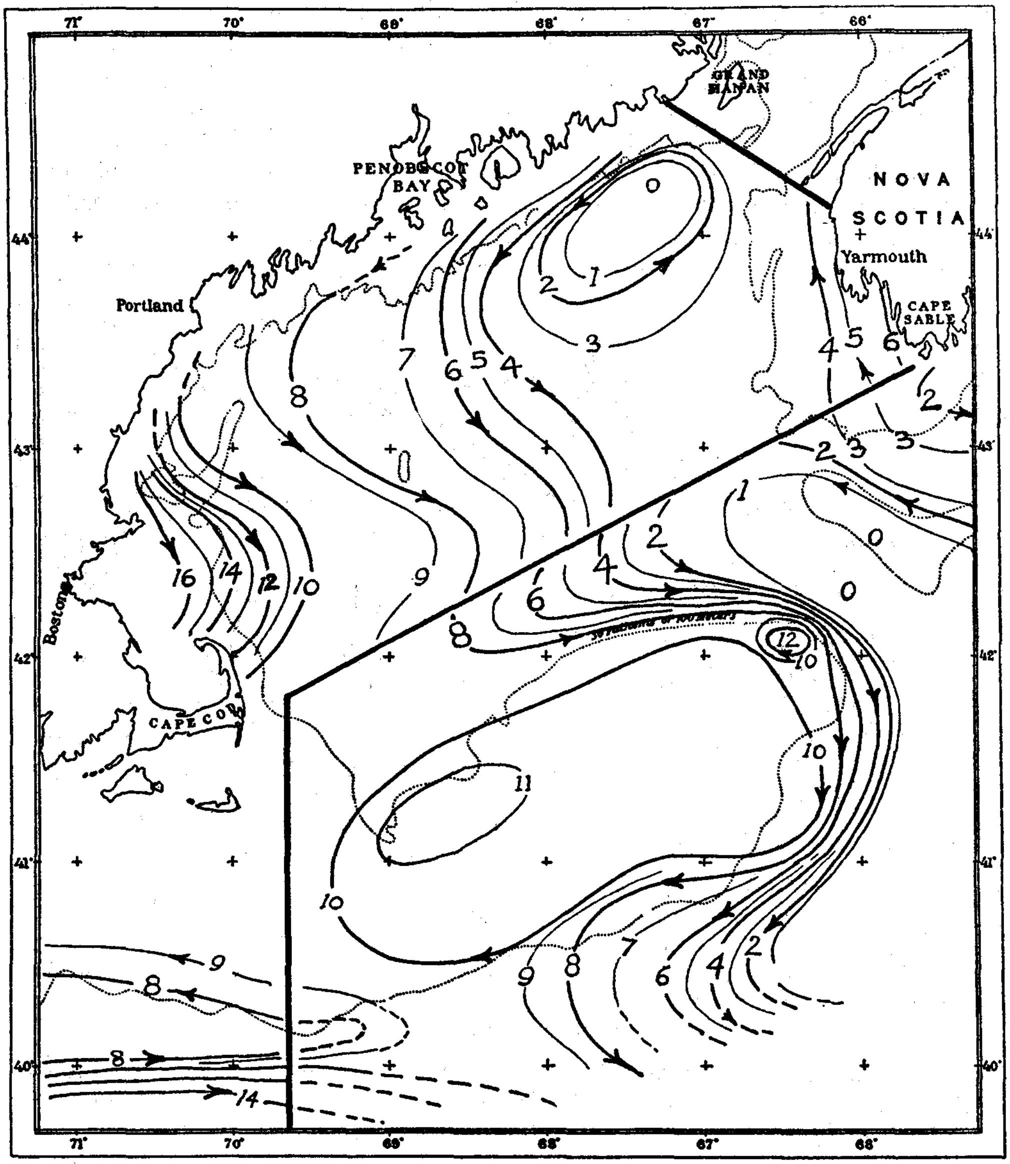

FIG. 203.—Dynamic gradient at the surface, July to August, 1914, referred to a base station in the Eastern Channel. The curves are for every dynamic centimeter. The picture south and east of the heavy dividing line is for July; north and west of it for August

are obviously the vortices of anticlockwise circulation, is the high in the offing of Massachusetts Bay. A slight gradient, west to east, is also shown from the northern low toward Nova Scotia in August; a steeper gradient of the same order northward toward the coast of Maine. There is every reason to suppose that the water was then lighter still (i. e., the surface potentially still higher) all along the coast westward from Mount Desert, where no observations were taken that summer.

Only in one small region did the dynamic contours for that July prove nonconformable to those of August—namely, in the immediate offing of Cape Sable. Here a slope rising from Browns Bank across the Northern Channel gave place to a potential dip next the cape in July, reflecting the high density of the cold water next the Nova Scotian coast reminiscent of the Nova Scotian current of a month or two earlier. Consequently, while the surface water over the Northern Channel was then drifting toward the gulf, that next the cape was drifting away from it; but the rising temperature of the next three weeks (combined with considerable freshening) so decreased the density of this relict water that by mid August a rising slope was recorded from German Bank in toward the cape, corresponding to the northerly drift toward the Bay of Fundy with which so many drift bottles have journeyed. Observations taken near Yarmouth, Nova Scotia, by Vachon (1918) in September, 1916, make it probable that in summer this sector of the coast line is normally fringed by water relatively lighter than is shown on the chart for 1914 (fig. 200).

The distribution of density in the Bay of Fundy in summer has been studied by Mavor (1923). Here the lightest water lies along the northern side in the upper 60 to 80 meters, the heaviest bottom water banking up in the central part of the basin in depths greater than about 100 meters. This type of distribution, as Mavor (1923, p. 364) makes clear, must tend to develop a surface drift from east to west toward the mouth of the bay along the New Brunswick shore. The "rising of the cold (below 7°) and salt (above 33 per mille) water in the middle of the section" indicates, as he remarks, an anticlockwise rotation of the bottom water guided by the contour of the slopes, which is consistent with the bottle drifts (p. 868).

So long as the dynamic contour of the surface of the gulf is of the general type shown on Figure 203, a generally anticlockwise type of circulation will tend to dominate the whole basin, centering some 40 to 60 miles offshore in the offing of Mount Desert Island, with a subsidiary eddy, likewise anticlockwise, involving the Bay of Fundy. The contour lines show that a southwesterly drift is then to be expected off Mount Desert Island and past Penobscot Bay, but one constantly tending offshore, veering rather abruptly southward and southeastward in the offing of Casco Bay and so out across the basin.

Off Cape Ann, too, the dynamic drift tended to the southeast in August, 1914; but a division was indicated there, with the coastal water recurving toward Cape Cod.

Comparison with the bottle tracks makes it evident that dynamic circulation of this type corresponds very closely to the drifts of the bottles set out off Mount Desert, as these have veered from southwest through south and east and so northward along the Nova Scotian coast (figs. 183 and 184). The center of this eddy movement, however, seems to have been situated a few miles farther south and west in 1923 than the dynamic chart (fig. 203) shows it for 1914.

These dynamic contours also correspond to the southeasterly component of the tracks of bottles set out off Cape Elizabeth (figs. 180 to 182) and with the fact that most of these turned offshore from the beginning and did not parallel the coast line southward toward Cape Ann, as happens earlier in the season.

It is not so easy to reconcile the continued drifts of these Cape Elizabeth bottles toward Nova Scotia and the Bay of Fundy with the dynamic contours, for the latter suggest that any driftage from the northern coast of the gulf that reached the central part of the basin would rather be drawn into the circulation around the heavy center in the Eastern Channel, and so be carried outward around the eastern end of Georges Bank. This, in fact, seems to have been the fate of some of the bottles set out off Cape Ann and of most of those set out off northern Cape Cod in 1923 (fig. 176). It seems reasonable, therefore, to conclude that by the end of July or first of August of most years the zone of demarcation between the eastward drift around the southern side of the northern heavy pool and the counter drift around the northern side of the southern pool is located somewhat farther south than it was in August, 1914—not far, in fact, from the line of monthly separation laid down on the chart for that year (fig. 203).

The distribution of density around the eastern slopes of Georges Bank affords a striking illustration of the necessity for taking account of the difference in depth between pairs of adjacent stations in the dynamic calculations, arbitrary though this correction be (p. 934). Without the inclusion of this factor (p. 934), the dynamic head between the low over the Eastern Channel and the high surface over the neighboring part of Georges Bank would have been only about 1 to 2 dynamic centimeters in July, 1914 (except for one station at the extreme edge of the bank—station 10226—where an isolated pool of low density was recorded). Inclusion of the difference in depth increases this gradient to about 10 dynamic centimeters, working out at a relative velocity of about 0.5 knot out of the gulf around the eastern end of the bank (except as interrupted by a subsidiary clockwise circulation around the light center, just mentioned), which is probably a closer approximation to the truth.

The dynamic gradient along the southern edge of Georges Bank for July, 1914 (fig. 203), offers an explanation for the fact that none of the bottles from the lines set out off Cape Ann and off northern Cape Cod, which have gone out of the gulf around the eastern end of Georges Bank, have been reported from west of the longitude of Cape Cod, when so many set out to the south of the cape have gone in that direction (p. 881; figs. 174 and 176). With the dynamic contours turning southward to sea from the eastern end of the bank, and with the surface gradient rising from longitude 67° to longitude 68°, the March state (fig. 188) is recalled.

The reasonable expectation with this dynamic distribution is that driftage leaving the gulf by this route would circle offshore somewhere abreast the eastern part of Georges Bank, to be carried toward the northeast, finally, with the so-called "Gulf Stream drift." It is probable, also, that at least three bottles that went to England and to Ireland from the Cape Ann and northern Cape Cod lines of 1923 (fig. 176) followed this route.

The whole area of Georges Bank was comparatively dead water in July, 1914, just as in March; consequently no dominant movement is indicated across it either into or out of the gulf, which is corroborated by the evidence of temperature and of salinity. The bank as a whole is therefore made the center of a clockwise type of dynamic circulation in July, just as the inner part of the gulf is of an anticlockwise type.

The dynamic state is not so clear for the southwestern part of the banks area in summer, where the rise in temperature during the time interval between the two cruises of 1914 (July 20 to 21; August 25 to 26) may have been more than counterbalanced by some encroachment of water of high salinity inward over the shelf. Consequently, the dynamic values for the offing of Marthas Vineyard for that August are not directly comparable with those taken farther east during the month preceding. However, no gradient is suggested sufficient to account for the repeated drifts of bottles westward around Nantucket Shoals from the vicinity of Cape Cod.

The dynamic relationship along the continental slope in the offing of Marthas Vineyard and eastward about to longitude 68° for July and August, 1914 (fig. 203), recalls the March state (p. 939; fig. 188) so closely that a low or dynamic trough, with the gradient rising to seaward as well as shoreward, may be taken as typical of

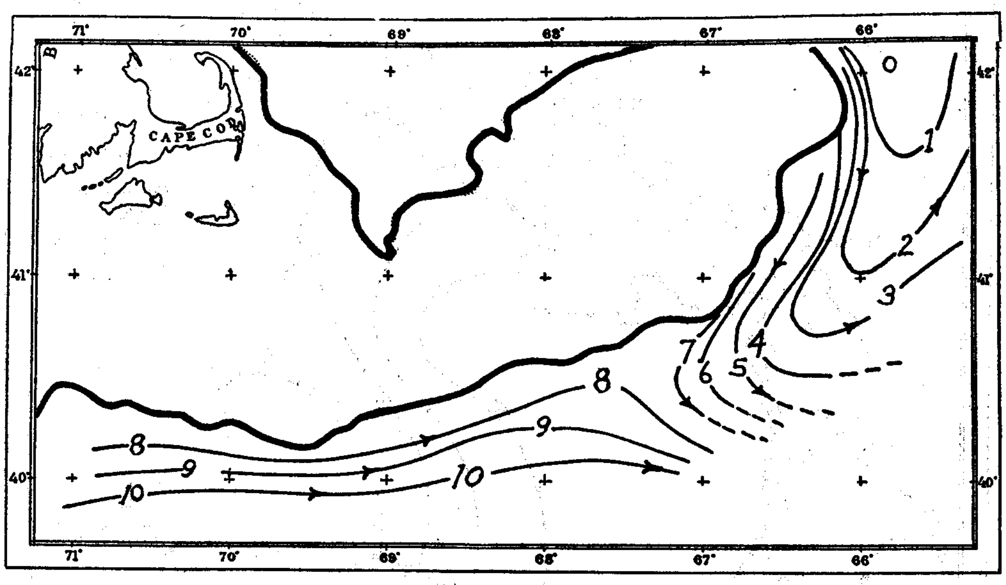

FIG. 204.—Dynamic gradient along the continental slope, bottom to 100 decibars, July to August, 1914. Contours for every dynamic centimeter

this belt. Its circulatory implication has already been discussed (p. 939). At the date of our August profile for 1914 the calculated velocity of the easterly or "Gulf Stream" drift along the offshore edge of this low, and relative to the latter, was at least half a knot off Marthas Vineyard, or about the same as in March, 1920 (p. 939),[93] which corresponds very well with the average velocities reported in this sector of the so-called "inner edge of the Gulf Stream" by passing ships in summer.

The dynamic contours at 100 decibars for that July and August (fig. 204) show the easterly set actually washing the continental slope to the west of longitude 68° then swinging offshore. We have here a ready explanation for the fact that water of high temperature and high salinity—the "warm zone"—usually bathes the slope along this western section but is separated from the slope farther eastward by the colder counter drift out of the Eastern Channel.

[93] For the reasons stated above (p. 939), the calculation of velocity in this region can be taken only as a rough approximation.

In August, 1914, the bottom water of the gulf, as represented by the dynamic contours at 150 decibars (fig. 205), tended dynamically to drift across the basin from northeast to southwest—i. e., from the Nova Scotian slope and the offing of the Bay of Fundy toward the southwestern side of the basin, closely paralleling the March state (p. 941; fig. 190). The mechanism by which the deeps in the offing of Cape Ann are kept supplied with slope water that has previously entered the gulf is thus made clear. However, no direct dynamic drift seems to have been operative through the Eastern Channel in either direction at depths as great as this that July or August, contrasting with the strong outflow along its western side at the surface at the time (fig. 203; p. 958).

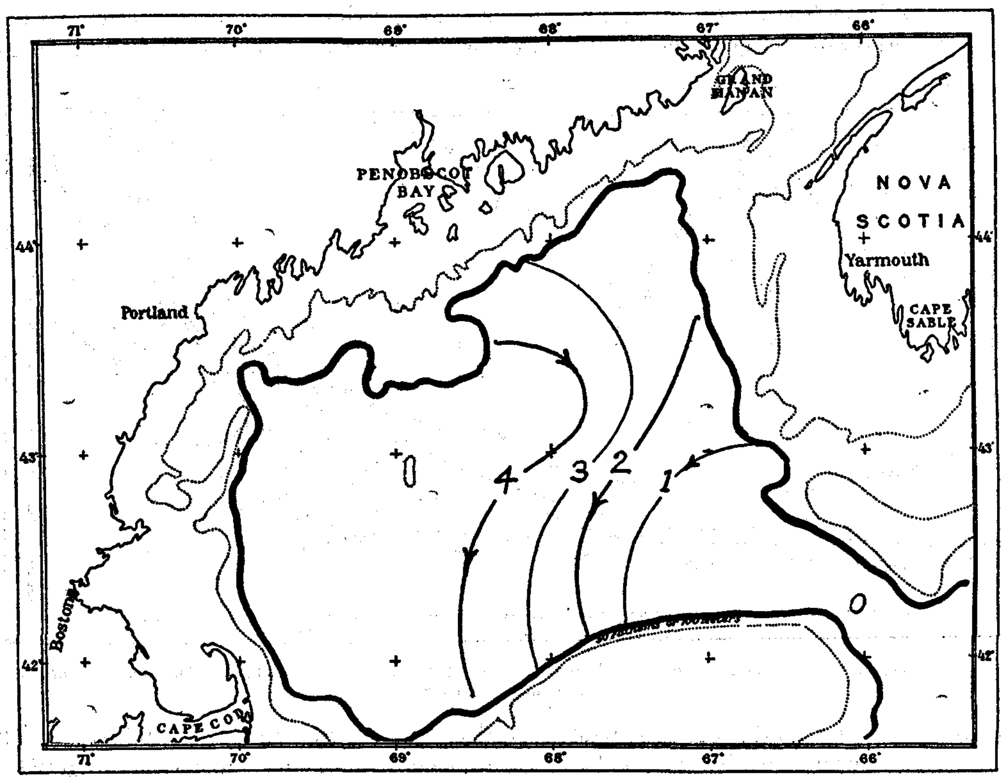

FIG. 205.—Dynamic gradient, bottom to 150 decibars, July to August, 1914. Contours for every dynamic centimeter

To test the constancy of the dynamic state of the gulf from summer to summer, a dynamic chart of the surface is also offered for August, 1913 (fig. 206, stations 10086 to 10106). Unfortunately this is not as trustworthy as the chart for 1914, because considerable interpolation of values, both for temperature and for salinity, was necessary in its construction. It is probable, also, that there was some error in the one or in the other, as recorded for two stations in the eastern side of the basin (stations 10092 and 10093), accounting in part for the contrast between the two. Nevertheless, the general gradient that results is so consistent, from station to station, that it may safely be taken as an approximation to the actual state of the northern and western parts of the gulf at the time.

Obviously, the center for the general anticlockwise gulf eddy lay considerably farther offshore in that summer than in 1914—according to the chart approximately 50 miles south of Mount Desert Island. The general drift in the northwestern and western sides of the gulf, then, more nearly paralleled the coast line from northeast to southwest, and so southward past Cape Elizabeth toward Cape Cod. Under these circumstances drifts might be expected more closely to approximate the tracks of the bottles that went from the Bay of Fundy to Cape Cod in 1919 (p. 870), rather than to show the offshore trend characteristic of the series set out off Mount Desert and off Cape Elizabeth in the summers of 1922 and 1923 (p. 895).

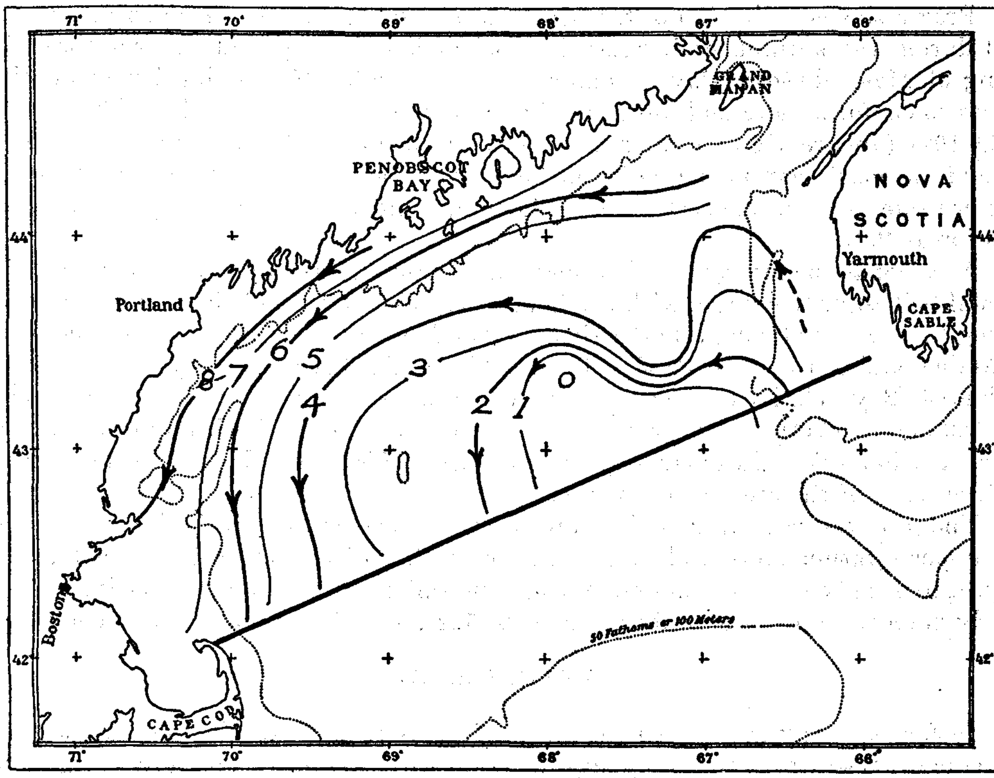

FIG. 206.—Dynamic gradient at the surface, August 4 to 20, 1913. Contours for every dynamic centimeter

In August, 1913, no data were obtained closer to the Nova Scotian coast than German Bank; but a higher surface in over the latter than over the basin suggests the northward drift to be expected on this side of the gulf. As it happens, this general scheme is obscured by a rather complex interaction between light and heavy water over the eastern side of the basin, which may, perhaps, mirror nothing more than some observational error at one or other of the two stations concerned (10092 and 10093).

Unfortunately, no observations were taken in the southern or southeastern parts of the area in August, 1913. However, the distribution of salinity (p. 767) makes it probable that the heavy water in the offing of Mount Desert was then entirely surrounded by lower densities to the south, and so separated from equally heavy water to be expected near the Eastern Channel and through the trough of the latter, just as was the case in July and August, 1914. The available data thus suggest that the dynamic tendency toward circulation continues regularly anticlockwise from summer to summer in the northern and northwestern parts of the gulf, though differences in the location of its center of revolution and in the regional distribution of density off the western shore are correspondingly reflected in the stream lines.

AUTUMN AND WINTER

Progressive equalization of temperature taking place in the shoaler strata of the gulf during the autumn obliterates the pool of low density that characterizes the offing of Massachusetts Bay in summer. As a result, the distribution of density comes to conform more and more closely to that of salinity. In the midwinter of 1920–1921 (apparently a representative season), the upper 100 meters were less dense around the coast than in the basin offshore, with the transition more abrupt in the western side than in the eastern, and the values highest in the offing of Cape Ann (station 10490).

A regional inequality of this sort must cause a dynamic tendency for the coastal belt to drift parallel with the land anticlockwise around the gulf, much as in spring (p. 942), producing a northerly set along Nova Scotia, westerly along the coast of Maine, and southerly from the offing of Cape Elizabeth past Cape Ann to Massachusetts Bay, relative to the underlying water mass. This latter (as represented by the 150-meter level) then proved nearly uniform in density horizontally (i. e., was nearly stationary). Unfortunately, no data are available for the southern or southeastern parts of the area for midwinter.

The progressive mixing of the water that takes place as winter advances makes the upper stratum more and more uniform, both horizontally and vertically, with respect to density as well as in temperature and salinity, until by February it becomes nearly homogeneous, as described above (p. 522), and the annual cycle is complete.

WIND CURRENTS

Seafarers have known, from the dawn of history, that the wind sets up surface currents often so strong that they must be taken seriously into account in navigation; and many a good ship has been wrecked from ignorance of the wind current.

In the Gulf of Maine the motive effect of the wind is made most apparent to the oceanographer by the upwellings of colder and salter water from below, which take place along its western margin when the surface water is driven offshore (p. 550). Every fisherman along our coasts knows from first-hand experience that strong winds, blowing from one quarter or another, strengthen the ebb at the expense of flood—or vice versa, as the case may be.

The dynamic principle according to which wind currents are produced is extremely simple: The wind drives the surface water before it, the motion of the latter being propagated to underlying strata by the internal friction of the water. Once in motion, the water, as Nansen (1902) and Ekman (1902) have pointed out, must be deflected by the effect of the earth's rotation. Nansen's (1902) observations on the drift of

Arctic ice, with subsequent studies of currents at lightships and analyses of wind and drift at localities widely separated in the Baltic, North Atlantic, Mediterranean, North Pacific, and Adriatic unite in proving that the wind drift does, in fact, average to the right of the wind in the northern hemisphere, to the left of it in the southern, as theory demands.

According to Ekman's (1905) more recent mathematical analysis, the surface drift in a free ocean of unlimited depth will be deflected 45° to the right of the direction of the wind in the Northern Hemisphere, more and more to the right with increasing depth, but decreasing correspondingly in velocity until a level (the so-called "frictional depth" is reached where the drift is opposite the wind but at only about one twenty-third the strength of the surface current. The depth of this level depends on the strength of the wind and on the latitude; theoretic calculation for homogeneous water of a specific gravity (1.025) approximating that of the shoaler water of the Gulf of Maine (Smith, 1926, p. 47, Table 14) locates it at 45 to 90 meters for the latitude of the Gulf of Maine, with winds ranging in strength from 15 to 20 nautical miles per hour (Beaufort scale, 3 to 4).

The Gulf of Maine lies within the belt of variable winds, frequently reversing in direction. The length of time required for the full development of a wind current is therefore important. This is affected by many factors; but Ekman's mathematical study with the measurements of wind and currents, which have been made at lightships in various seas, makes it almost certain that only a few days are required at the latitude of the Gulf of Maine. It is therefore reasonable to assume that winds prevailing from a given quadrant of the compass for 50 to 70 per cent of the time, such as actually blow over our gulf, are sufficiently constant in direction to play a major rôle in governing the circulation of at least the upper stratum of water, if not of the deeper levels.

If, then, the water of the gulf were homogeneous, free to move in any direction, and considerably deeper than the "frictional depth," moderate winds, blowing comparatively steadily from one general direction for a few days, should set the whole upper 45–90 meters in spiral. Actually, however, the vertical stability and generally stratified state of the water of the gulf tend greatly to limit the depth to which wind currents may be expected to penetrate downward.

The angular deviation of the wind current from the direction of the wind may also differ widely at sea from the theoretic expectation. If the depth of water be less than the frictional depth, the angle will be less; and while this limitation does not affect the development of wind currents in the basin of the gulf, it does affect the coastal belt out, say, to the 40 to 50 meter contour. The vicinity of the coast line, with the contour of the bottom, also governs the directions which surface drifts, set in motion by the wind, must actually follow. The effects of these influences have also been attacked mathematically by Ekman (1905); but, as Krümmel (1911, p. 469) has emphasized, so many variables, which can not be exactly measured, enter in that the surface currents which the wind has actually been found to set up in other coastwise localities, in comparable latitudes, still afford the best available indication of what is to be expected in the Gulf of Maine.

Long series of measurements of the currents at various lightships in the Baltic[94] have shown the nontidal surface drift averaging about 30° to the right of the wind, and much more often to the right than to the left. Analysis by Forch (1909) of the relationship between the wind in the eastern Mediterranean, and the drifts there, as reported in ships' logs for the Arabian Gulf by Gallé (1910), have brought out a corresponding tendency for the current to set about 40 to 60° to the right of the wind.[95] According to the current tables published by the United States Coast and Geodetic Survey (1923), local winds off the eastern coast of the United States likewise produce currents setting about 20° to the right of the wind direction at a velocity about 1½ per cent of that of the wind.[96]

The Baltic measurements just mentioned had already proved that the current sometimes sets to the left of the wind, due, no doubt, to the effect of the coast line. This relationship between coast line and wind current has been brought out very clearly by a recent investigation of the currents at five lightships along the Pacific coast of the United States by the Coast and Geodetic Survey. For a detailed account of these observations the reader is referred to Marmer (1926 and 1926a). In summary they are as follows: Offshore winds and winds parallel to the shore, if having the latter to the left, produce surface currents averaging 20 to 25° to the right of the wind; but if the wind blows against a coast line lying to the right of its track, at an angle of 45° or less (i. e., a southwest wind against a north and south shore line), the current is deflected to the left as it strikes the coast, as might naturally be expected from ordinary observation on the behavior of the tides.

The observations tabulated below (p. 964) for Portland lightship also show the nontidal current drifting to the right of the wind during months when winds blowing toward the southern half of the compass favor the dominant southerly set. When the wind blows toward the north or northeast against the current, the latter may or may not be reversed. If it is, the resultant set may be either to the right of the wind or slightly to the left of it, depending on the complex interaction between direction and strength of wind, nontidal set, and the trend of the coast line.

Dominant surface set and prevailing wind at Portland lightship

Month	Current [a]	Wind [a]	Current to right	Current to left
1913				
October	S. 67° W	S. 2° E	69°	
November	S. 31° E	N. 84° E	65°	
December	S. 11° W	S. 50° E	61°	
1919				
June	S. 36° W	N. 3° E		147°
July	N. 62° E	N. 28° E	34°	
August	S. 74° W	N. 33° E		139°
September	N. 47° E	N. 27° E	20°	
October	N. 58° E	N. 73° E		15°

[a] The directions are those toward which winds and currents set. For full data see pp. 861 and 862.

[94] Dinklage (1888), Witting (1909), summarized by Krümmel, 1911, p. 451.

[95] For theoretic discussion and explanation of modern mathematical methods of calculating wind currents see Ekman (1905), Krümmel (1911), Sandström (1919), and Smith (1926).

[96] This statement has as its basis current measurements taken at a large number of localities, some of which are discussed above (p. 963).

The following tables, supplied by the United States and Canadian weather bureaus, show the prevailing winds, by months, for several stations around the coast of the gulf and over the latter.

Average percentage of winds from each direction (10 years, 1911 to 1920)

BOSTON, MASS.

Month	North	North-east	East	South-east	South	South-west	West	North-west
January	10	5	2	6	3	23	28	23
February	11	5	4	3	5	17	31	24
March	12	7	6	6	8	17	24	20
April	9	11	12	7	6	16	18	21
May	8	9	13	8	8	21	18	15
June	10	9	15	6	6	23	18	13
July	5	6	10	5	8	33	21	12
August	7	8	10	7	11	25	18	14
September	11	7	6	8	9	22	19	18
October	9	7	7	7	10	23	20	17
November	10	4	4	4	7	20	32	19
December	10	4	3	3	5	16	32	27
Average for 3 winter months	10	5	3	4	4	19	30	25
Average for 3 summer months	7	8	12	6	8	27	19	13
Average for year	9	7	8	6	7	21	23	19

PORTLAND, ME.

Month	North	North-east	East	South-east	South	South-west	West	North-west
January [1]	21	6	1	3	6	19	19	24
February [1]	22	4	1	4	8	17	19	24
March	17	6	3	5	13	15	18	23
April	18	12	6	4	13	13	14	20
May	12	10	9	7	21	14	12	15
June	10	11	10	8	18	14	13	16
July	11	7	7	6	25	19	15	10
August [1]	9	7	9	8	23	18	11	14
September [1]	14	7	4	5	18	19	12	20
October	15	4	4	6	15	22	15	19
November	18	4	2	4	8	24	19	21
December	21	4	1	3	5	21	19	26
Average for 3 winter months	22	5	1	3	6	19	19	25
Average for 3 summer months	10	8	9	7	22	17	13	13
Average for year	16	7	5	5	14	18	15	19

EASTPORT, ME.

Month	North	North-east	East	South-east	South	South-west	West	North-west
January	11	7	5	4	8	17	27	21
February	11	9	4	4	6	16	28	22
March	10	8	5	5	13	17	20	22
April	12	14	8	3	17	16	13	17
May [1]	10	11	6	3	30	16	9	14
June	6	12	7	4	31	15	11	14
July [2]	6	9	3	2	40	21	8	9
August [1]	4	9	4	3	38	18	10	13
September [1]	9	6	5	3	22	21	12	21
October	10	6	5	2	22	20	14	21
November	10	9	4	3	9	24	21	20
December	14	7	6	4	6	13	27	23
Average for 3 winter months	12	8	5	4	7	15	27	22
Average for 3 summer months	5	10	5	3	37	18	10	12
Average for year	9	9	5	3	20	18	17	18

[1] One per cent calm. [2] Two per cent calm.

Average percentage of winds from each direction (10 years, 1911 to 1920)—Continued

YARMOUTH, NOVA SCOTIA

Month	North	North-east	East	South-east	South	South-west	West	North-west	Calm
January	15	12	10	9	6	10	6	30	2
February	16	13	9	8	7	7	7	29	4
March	17	9	7	7	9	11	10	26	4
April	13	10	10	8	9	12	13	20	5
May	11	6	6	10	16	18	15	16	2
June	8	3	6	8	20	20	15	14	6
July	5	3	4	6	20	31	14	8	8
August	6	2	5	6	20	23	11	14	13
September	13	7	6	7	14	15	11	15	12
October	15	8	9	7	14	18	10	13	6
November	15	12	10	5	6	14	11	23	4
December	16	14	10	8	5	10	5	30	2
Average for 3 winter months	16	13	10	8	6	9	6	30	-------
Average for 3 summer months	6	3	5	7	20	25	12	12	-------
Average for year	13	8	8	7	12	16	11	20	-------

Five-degree square, including Gulf of Maine, from pilot charts

Month	Percentage of winds from the most frequent quadrant	Month	Percentage of winds from the most frequent quadrant
January	North to west, 63.	July	West to south, 68.
February	North to west, 73.	August	West to south, 50.
March	North to west, 57.	September	Northeast to northwest, 49.
April	North to west, 58.	October	North to west, 58.
May	West to south, 50.	November	North to west, 64.
June	West to south, 45.	December	North to west, 63.

These tables may be briefly summarized as follows:

Along the western and northern shores of the gulf the wind blows most often between southwest and north in winter, averaging about northwest. In summer southwesterly and southerly winds prevail. On the eastern side of the gulf the wind averages more westerly (south to northwest) in summer, northerly (between northwest and northeast) in winter. Over the offshore waters of the gulf, where the direction of the wind is not so much influenced by the diurnal warming and cooling of the land, the prevailing winds are between west and north (though with requent reversals) from November to April; between west and south from June to August; more variable in late spring and again in early autumn.

In summer, by theoretic expectation, winds of this character would tend to produce a general drift of the surface water about 20° to 45° to the right of the octant, north to northeast—i. e., toward the northeast and east. Thus, the prevailing winds favor the general drift out from the western side of the gulf and eastward across the southern part of the basin toward Nova Scotia, which prevails at that season (p. 974). Striking Nova Scotia, this wind current would tend to bank up against the coast, raising the level of the sea slightly. Thereupon hydrostatic forces are brought into play, dynamically, against the wind; but any resultant movement of the water out from the land being in turn deflected to the right by the earth's rotation, a northerly drift might be expected to result along Nova Scotia, and in this instance theoretic expectation agrees so well with the drifts of bottles actually recorded that the prevailing southwesterly winds of summer certainly assist the surface drift from south to north, which characterizes the eastern side of the gulf at that season, though as certainly not the only motive force for it.

Thus, the wind then tends to act as a motive force for the southern and eastern sides of the Gulf of Maine eddy.

It is obvious, however, that no matter how steadily the wind blew from the southwest it could not drive the entire surface of the gulf eastward unless the water were nearly enough homogeneous to allow a sinking current to develop in the eastern side, with the deeper stratum so fed flowing back from east to west, to well up again, in turn, in the western side. Circulation of this sort probably does take place to some extent along the Nova Scotian side of the gulf, in the Bay of Fundy, and along the coast of Maine east of Mount Desert, where active tidal currents keep the water so thoroughly stirred that it has little stability at most times of year. It is certain, also, that offshore winds do cause more or less upwelling along the western shore line, but the basin of the gulf as a whole, with its western and northwestern margins, is so stable vertically that hydrostatic forces very strongly oppose any such "jibing," as Sandström (1919) terms it. Consequently, any constant movement of the surface water northward toward the Bay of Fundy would tend to cause an "overflow" in the shape of a westerly drift along the coast of Maine—i. e., *against* the winds prevailing in summer.

It is obvious that if the water be in stable equilibrium, southwesterly winds might or might not set a closed circulation of this type in motion, depending on their relative strengths and constancy in various parts of the gulf; depending, too, on the balance in various parts of the gulf between the hydrostatic forces opposing jibing and the tendency of the wind to cause that process, as just explained. To value these several factors will require a knowledge of the gulf and of its winds much more intimate than can yet be claimed. It is certain that with winds reversed as often as they are over the gulf the balance varies constantly. However, the preceding analysis does make it clear, I think, that any eddying circulation which the southwesterly winds of summer might set up in the surface stratum of the gulf would shortly assume the anticlockwise character that, by evidence of more direct sorts, does actually dominate its basin. Consequently, the summer winds parallel the hydrostatic forces set in operation by regional inequalities of density in their general effects to this extent. On the other hand, the current flowing southward and out of the gulf past Nantucket Shoals, which forms part of the overflow from the gulf, is at right angles to the potential wind drift, hence holds its dominant set in spite of the prevailing wind. Neither can the wind be held responsible for the westerly drift of slope water along the continental edge in summer, because this current sets directly against the drift which the prevailing southwesterly winds would tend to produce there.

The wind current, as it extends its effects deeper and deeper below the surface, will turn more and more to the right of the wind (losing, also, in velocity by geometric progression); also, with increasing depth the gulf becomes more and more nearly inclosed, so that any currents, however set in motion, are more and more directed by the contour of the bottom.

The depth to which currents of wind origin do actually penetrate in the Gulf of Maine is therefore of immediate interest. Unfortunately, no mathematical method yet suggested can measure this, even approximately. However, it is certain that the stable state of the water of most parts of the gulf ordinarily confines wind currents to a stratum much shoaler than the theoretic "frictional depth" as calculated by Smith for homogeneous water at corresponding latitudes (p. 963).

With an average wind strength of 3 to 4, by the Beaufort scale (a fair average from the gulf in summer), this depth is set by him as about 43 to 70 meters at latitudes 40° to 50°. It is not likely, however, that the wind ever sets water as stable as that of the western side of the gulf in motion half so deep as this during the brief periods when it blows steadily from any given direction at a strength as great as 4, on the Beaufort scale (about 20 nautical miles per hour), during the summer months. With the more usual summer breezes no stronger than 10 to 15 miles per hour (2 to 3 on Beaufort scale), the frictional depth must be even smaller. Frequent reversals of the wind direction, with periods of calm, also further hinder the propagation of wind currents downward into the underlying water. On the whole, then, it is unlikely that wind currents are effective deeper than 10 to 20 meters in the gulf in summer, except perhaps during brief periods of windy weather. Even if this limitation be too small it leads to the important conclusion that whatever currents may be set up in the gulf in summer by the wind are confined to a very thin superficial stratum, and that the dominant anticlockwise and estuarine circulation of the deep water below the 40 to 50 meter level is caused by hydrostatic forces and by the tidal oscillations (p. 970).

The pulses of slope water into the gulf via the trough of the Eastern Channel are equally independent of the wind.

In winter the winds of the gulf of Maine area blow stronger (average about 3 to 5 on the Beaufort scale), and the prevailing quarter is northwest (p. 966). Winds of this character tend, theoretically, to drive the surface water of the whole gulf out to the southward, toward the open sea. Probably it is this prevalence of strong offshore winds all along the North American seaboard, from Chesapeake Bay to the Gulf of Maine, during the cold season, which is primarily responsible for the recession of the tropical water from the edge of the continent during autumn and winter, their cessation allowing its inshore movement in summer. The prevailing northwest winds of winter tend, therefore, to strengthen the dominant southerly drift along the western side of the gulf. With the coast line trending north and south, the deflective effect of the earth's rotation gives a long-shore character to currents caused by winds from this quarter, except so close in to the land that the whole depth of water is less than the frictional depth. Under these last conditions (by Ekman's calculation) the wind current will set more nearly with the wind than in deeper water offshore.[97]

Consequently, the prevailing winter winds from the northwest quadrant do not tend to cause any general or constant upwelling along the coast sector from Cape Ann to Cape Elizabeth except within 2 to 3 miles or so of the land, where the water is shoaler than one-fourth the assumed frictional depth of 50 meters. This is corroborated by our station data, but upwellings, such as are actually recorded (p. 588), necessarily tend to follow these same west to north winds along the north shore of Massachusetts Bay. This same tendency for water to well up from below must operate spasmodically throughout the winter all along the coast of Maine, where

[97] Theoretically, 21.5° to the right of the wind, if the depth of water be one-fourth the frictional depth.

prevailing winds (and the strongest winds), between west and north, drive the surface water offshore to the southward.

By this reasoning wind currents go far to explain the very interesting fact that in April the freshening effect of the spring freshets is so much more evident (in lowered salinity at the surface) along the coast sector west and south of the Kennebec than it is off Penobscot Bay (fig. 101). The discharges from the former, from the Saco, and from the Merrimac, driven southward by the prevailing northwesterly winds of March and April, parallel the trend of the coast and so preserve the identity of the coastwise belt of low salinity. Off Penobscot Bay, however, the more or less active upwelling that must follow this same southerly drift off this west-east coast line, combined with tidal stirring, tends to prevent the development of so fresh a band next the land, but at the same time to carry the least saline water farther out from the land. The distribution of salinity at the surface for March and April, 1920 (figs. 91 and 101), is of this sort.

It is probable that the development of a tail of very low salinity from the St. John River southward across the Bay of Fundy in April (p. 808) similarly reflects a southerly set caused by the northwest winds, which often blow strong there during the first month of spring, though their average direction veers through west to southwest during April.

The pool of low-surface salinity spreading out to the southwest from Nova Scotia, which appears on the surface chart for March, 1920 (p. 703; fig. 91), likewise finds plausible explanation as a wind-driven drift out from the bays south of Yarmouth, where northerly winds prevail in February (p. 966).

The effects of the winter winds are more puzzling in the eastern side of the basin of the gulf, where prevailing west-north winds tend to produce a southeasterly or southerly drift at the surface, but where the evidence of salinity and temperature points to a movement in just the opposite direction—i. e., northerly toward the Bay of Fundy in winter as well as in summer (p. 910).

It is evident here that although strong northerly winds may and no doubt do temporarily drive the surface water southward, the general dominant drift is caused not by the wind but by other forces (p. 976) strong enough to overcome the wind effect in the long run. Consideration of the depth to which wind currents may be set in motion corroborates this conclusion, because the frictional depth of the average winter wind of about 4, on the Beaufort scale, is theoretically only about 67 meters. Actually, the water of the eastern side of the gulf not being homogeneous, the depth of the wind current will be something less than this—perhaps 50 meters with the state of stability prevailing in winter. The thickness of the stratum which the wind can set in motion at an appreciable rate is still less.

According to the long series of observations on wind and current that have been carried out by the United States Coast and Geodetic Survey, the velocity of the wind current is 1.5 to 2 per cent that of the wind—say, about 0.4 knot, with a wind of 4 (Beaufort scale, 20 nautical miles per hour). Smith's table of theoretic velocities (Smith, 1926, p. 46, Table 8), applied to a current of this strength with assumed frictional depth of 50 meters, gives a residual current of only 0.2 knot at a depth of 10 meters, about 0.15 knot at 20 meters, and 0.07 knot at 30 meters. Theoretically (in a free ocean), in the example just stated the current at 10 meters should set 36°

to the right of the surface current, the water at 20 to 30 meters 72° and 108° to the right of it, respectively.

This calculation shows that even in winter wind currents are virtually negligible in the Gulf of Maine at depths greater than, say, 20 meters, and so weak at 10 to 15 meters that they can oppose but little resistance to hydrostatic forces or to tidal oscillations (as deflected by the earth's rotation), which may tend to drive the water in the opposite direction.

The general effect of the wind on the circulation of the gulf may be summarized as follows: In summer the prevailing southerly-southwesterly winds tend to maintain the anticlockwise circulation of the surface water, so far as they are effective at all in producing a constant circulation. It is probable, also, that the easterly set caused by the wind is chiefly responsible for the accumulation of the surface pool of high temperature, though low salinity, in the offing of Massachusetts Bay, which is characteristic of July and August. The outflow that takes place southward past Cape Cod and over the eastern end of Georges Bank, however, is against the prevailing wind. In winter the prevalent northwesterly winds assist the southerly drift in the western side of the gulf and are the chief cause for the wider dispersal of water of low salinity off its northern shore than off the western, but the general movement of water inward (northward) along the eastern branch of the basin is contrary to the wind.

Winter as well as summer wind currents are confined to the upper 10 to 20 meters. Consequently the dominant circulation of the deeper strata does not receive its motive power from this source.

HORIZONTAL TIDAL OSCILLATIONS AS DEFLECTED BY THE EARTH'S ROTATION

Huntsman (1923, 1923a, and 1924) recently has suggested that the tidal oscillations deflected by the effect of the earth's rotation are the chief motive force for the great eddies, anticlockwise and clockwise, that occupy the basins and circle about the islands and submarine banks in high latitudes. In his own words (Huntsman, 1924, p. 278), "the rotation of the earth" acts "as an imperfect valve in diverting the ebb and flood toward opposite sides of the channels and basins," thus causing a balance of inflow on the one side, of outflow on the other.

That the earth's rotation must exert a deflective effect on the tidal currents is beyond dispute. It is equally clear that if the oscillatory (back and forth) movement of the tides of any partially inclosed basin be altered by any agency into a progressive forward movement, the current, like any other, will be held against the right-hand bank in the northern hemisphere by the deflective force of the earth's rotation, and thus circulate anticlockwise, as Huntsman states. Furthermore, the deflective effect of the earth's rotation as it affects the tidal oscillation, if effective at all in this respect, must be most definitely so in regions where tidal currents attain considerable velocities at the strength of flood and ebb, as they do in the Gulf of Maine.

Beyond stating this proposition and certain applications of it to definite regions, Huntsman has not yet published any discussion of the dynamic principles involved, nor am I able to give it the physical analysis necessary for its proof or disproof.

However, there are certain grounds for concluding that Huntsman's theorem is probably effective in basins sufficiently inclosed, and that if so, the tides and earth rotation combined must have an unceasing pumping effect, working season in and season out on the following principle:

In the open sea, with no barrier to the free movement of the water, the rotation of the earth will merely change the track of ebb and flood (if flowing back and forth with equal velocity) from a right line to a closed ellipse; but in an inclosed basin, open to the tides only at one side, the case becomes altered by the fact that when the tide is flowing in the water is confined and prevented by the right-hand shore from eddying to the right. Consequently, the band of water closest the land on that side must either flow farther in, parallel to the coast, than it would if unconfined, or it must rise higher against the bank. No doubt both results actually follow. When the water next the land is so diverted from its normal path water farther out toward the center of the basin is correspondingly prevented from eddying to the right. Consequently, the effect of the shore line, in turning the flood tide to the left from the track it would follow if free to flow in any direction, extends far out to sea from the confining bank against which it presses. Under such circumstances the deflective effect of the earth's rotation tends to transform what is fundamentally an inshore current into a drift flowing into the basin in question, paralleling the shore line.

In the opposite side of the basin, which lies to the left of the flood tide, setting inward, this deflective force tends to turn the inflowing current away from the shore; consequently, it is reasonable to assume that the flood will not flow as far inward as it would otherwise. When the tide begins to ebb out of the basin conditions naturally are reversed, the ebb being driven against the coast, which is to the right of it (but to the left for the flood), and so carried farther out, but turned away from the side against which the flood was pressed as it flowed in.

The mobility of the water makes the picture exceedingly difficult to visualize or to represent by any diagram, and very likely complicated by vertical movements screwing forward, which I can not attempt to reconstruct; but as a net result it is reasonable to expect the flood to flow in farther than the ebb makes out in that side of the basin which is to the right of an inflowing current, and for the ebb to flow out farther than the flood makes in, in the opposite side. With a differential of this sort established an eddying movement would necessarily follow, forced to assume anticlockwise form by the confining shore line, in place of the clockwise character which the rotation of the earth would give it if not so opposed by the coast line or by the contour of the bottom. Translated into terms of the Gulf of Maine this would call for a dominance of flood over ebb (hence a northerly component) in the eastern side and a dominance of ebb over flood (i. e., a southerly component) in the western, such as has actually been demonstrated by drift bottles and by measurements with current meters.

Tidal currents in the gulf of Maine, the reader will recall, run nearly as strong right down to the bottom of the trough as they do at the surface. Consequently, Georges Bank, confining the basin on the south, should act as a coast line toward the deep tidal circulation, producing a west-east drift paralleling its northern slopes, if the foregoing analysis be correct. Here, again, the theoretic expectation is actually reproduced by the drifts of bottles that have crossed the southern side of the gulf from west to east (p. 886), corroborating Huntsman's (1923a, p. 18) conclusion that the dominant circulation in basins of this sort is kept in motion by the deep currents, not by the movements of the surface water. The clockwise drifts, which have been found to circle (or partly circle) several of the submerged banks (Georges, for instance (p. 974), and Nantucket Shoals), are also equally good evidence of dominance of the general circulatory scheme by the current flowing over the bottom, which the banks deflect just as islands would.

SUMMARY OF THE HORIZONTAL, NONTIDAL CIRCULATION OF THE GULF OF MAINE

The nontidal circulation of the Gulf of Maine (fig. 207) is essentially estuarine in type, as might have been expected from the contour of its bottom as well as from the trend of its coastline and from the large volume of fresh water discharged from the rivers tributary to it. The very considerable outflow from the gulf takes place at and near the surface—southward and westward past Nantucket Island and Shoals, in part, but in part as a clockwise movement circling around the eastern part of Georges Bank.

The evidence marshaled in the preceding pages—measurements with current meters, drifts of bottles, temperatures, salinities, distribution of the plankton in the superficial waters, and dynamics—can be harmonized with one type of dominant circulation only—a general anticlockwise eddy around the basin of the gulf. The demonstration of this, named by Huntsman (1924) and by me the "Maine" or "Gulf of Maine" eddy, with all it implies in its biological bearing, is perhaps the most interesting result of the joint explorations of the gulf.

The circulatory features most clearly established within the gulf are as follows:

The eddying drift is operative throughout the year but differs in velocity, and generally in detail, from season to season. It is also complicated by subsidiary eddying movements in the Bay of Fundy, Massachusetts Bay, Vineyard Sound, around Nantucket and Nantucket Shoals, and around and over Georges Bank, which are clockwise around these shoals but anticlockwise in the bays and basins, as Huntsman has shown to be the rule in northeastern American waters.

In the late summer and early autumn, when our information is the most extensive (fig. 207), the surface stratum of the inner part of the gulf eddies anticlockwise around an area of high density, the precise location of which shifts, from summer to summer, from the offing of the Bay of Fundy to a center in latitude about 43° to 43° 30′, 60 to 70 miles southerly from Mount Desert Island.

The eastern side of the circling movement follows so definite a track northeastward and then northward, paralleling the coast of Nova Scotia, that at least 8 per cent of all the bottles yet put out in the gulf off Cape Ann and to the northward are known to have followed this route, no doubt with others not reported for one reason or another. The large number of bottles that have stranded on that coast shows a strong tendency inshore. This Nova Scotian side of the Gulf of Maine eddy also receives water in some volume from the dead zone off Cape Sable in summer, and in some years a westerly drift past Cape Sable into the gulf of Maine persists from spring through summer.

A definite indraft into the southern side of the Bay of Fundy along its Nova Scotian shore is sufficiently demonstrated. However, this involves only the outermost edge of the Gulf of Maine eddy, the inner part of which continues northward across the mouth of the bay, a route followed by some of the bottles.

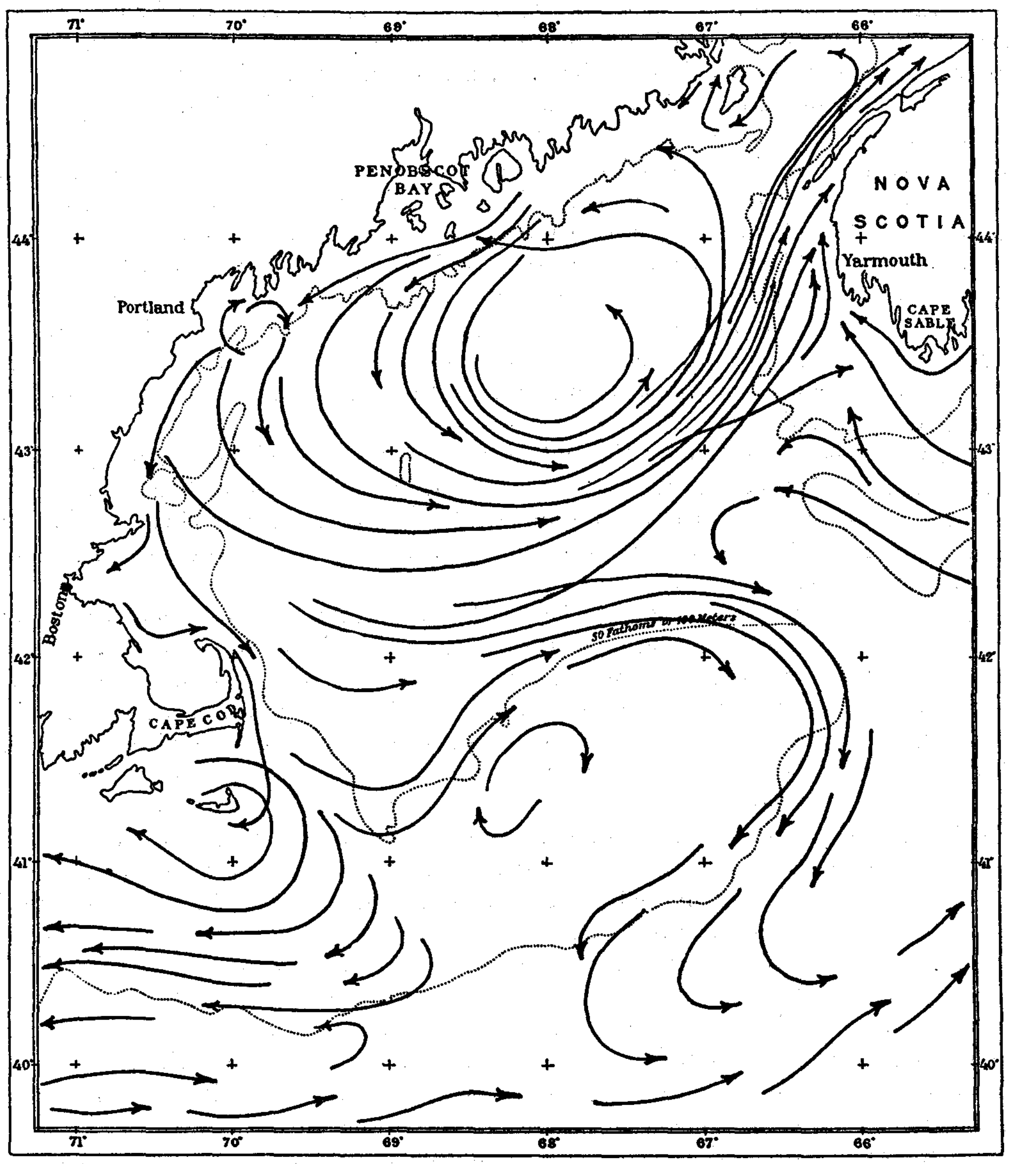

FIG. 207.—Schematic representation of the dominant nontidal circulation of the gulf, July to August

Within the Bay of Fundy the water eddies inward along the Nova Scotian side, outward along the New Brunswick side and to the southward of Grand Manan Island. However, there is some evidence that the latter forms the vortex of a second eddy of the opposite sort (clockwise) carrying water inward to the Bay of

Fundy along the Grand Manan shore of the Grand Manan Channel, with still another counter movement outward (westward) along the northern shore of the channel.

Bottle drifts identify the coastal belt between the west end of the channel and Petit Manan, some 35 miles to the westward, as to some extent a dead zone (p. 907) intervening between the coast line and the inshore edge of the gulf of Maine eddy; but the latter approaches close to the outer islands off Mount Desert.

In most summers the belt of surface water involved in the Gulf of Maine eddy is much broader in the western side of the gulf than in the eastern, with the general set more variable and its velocity smaller. As a rule a general tendency prevails for the surface water to move out from the shore all along the coast from Penobscot Bay to Cape Ann during July and August. Under these conditions a second dead area develops off the mouth of Casco Bay, with the water generally setting in the opposite direction (easterly or northeasterly) across it. A few miles farther out, however, bottle drifts and dynamic contours unite to show a decidedly definite continuation of the eddy southeastward and eastward across the basin, and so around again to Nova Scotia, dominating this side of the gulf north of an imaginary line, Cape Cod–Cape Sable.

This state is illustrated by the bottle drifts for 1922 and 1923 and by the dynamic gradients for the summer of 1914. In other summers (typified by 1913 and 1919) the westerly and southerly component of the Gulf of Maine eddy parallels the general trend of the coast line more closely as far as Cape Ann, even involving Massachusetts Bay.[98]

Somewhere in the offing of Cape Cod a division takes place between the outflow out of the gulf to the south and an easterly drift along the northern side of Georges Bank, the latter, as a whole, being the center of a clockwise system of circulation. As far as longitude 68°, or thereabouts, this easterly drift parallels the neighboring side of the Gulf of Maine eddy; but to the east of this there is a definite separation, with the water next the bank drifting around the eastern edge of the latter and so out of the gulf at considerable velocity, a fact made evident by bottle drifts as well as by dynamic evidence. Some clockwise movement is also to be expected around the shoal part of the bank; otherwise the latter is comparatively dead.

The bottle drifts, combined with current measurements, show the southerly outflow from the western side of the gulf continuing around or across Nantucket Shoals and so westward along the southern shores of New England and New York.

An easterly set has been found dominant in the entrance to Nantucket Sound, between Nantucket and Monomoy, in the only summers of record, contributing to the circling movement around Nantucket but not to the Gulf of Maine eddy. If this condition prevails as constantly as now seems probable, the local circulation of the water offers a reasonable explanation for the rather abrupt general division between the waters west and east of Cape Cod, biologic as well as hydrographic.

Bottle drifts suggest that this easterly outflow from Nantucket Sound is given off from the southern side of an anticlockwise type of circulation that involves the sound as a whole; but the tidal currents run so strongly there that more information is needed before this can be stated positively.

[98] *Vide* the drifts of bottles from the Bay of Fundy to Cape Cod in 1919.

In some summers, if not in all, the westerly drift just mentioned involves the surface water across the whole breadth of the continental shelf in the offing of Marthas Vineyard and Nantucket. This, however, can not be regarded as a direct continuation of the outdraft from the gulf around the eastern end of Georges Bank. On the contrary, the latter probably swings offshore to join in the easterly movement of the so-called "inner edge of the Gulf Stream."

The evidences of temperature, salinity, and of dynamic gradient unite to show this "Gulf Stream" current departing from the edge of the continent as it crosses the mouth of the gulf from west to east, so that while it may be encountered within 15 miles of the 200-meter contour line at longitude 69° to 70°, it is usually at least 40 to 50 miles out at longitude 66°. Farther east, however, it again approaches the slope, at least in some summers.

Our recent cruises have afforded no evidence of any movement across Georges Bank from south to north, though the surface water not infrequently drifts northward from the edge of the continent to the west of Nantucket Shoals during the late summer.

The chief seasonal variations from the circulatory scheme just outlined result during the autumn and winter from a shift in the heavy ("low") center of anticlockwise circulation to the Eastern Channel, from a speeding up of the coastwise drift around the northern and western shores in spring, and from the brief overflow of the Nova Scotian current into the eastern side of the gulf at that same season.

As a result we find the circulation centering chiefly around the Eastern Channel in March with velocities greatest as it drifts inward along the eastern side and outward along the western side of the latter. From March to April, however, the center of circulation shifts northward across the basin; the movement slackens in the southeastern part of the area, and the coastwise drift gathers strength. Shortly thereafter, when the water of the Nova Scotian current floods into the gulf from the east, the heavy center is shifted southwestward right across the gulf. At the same time (in May) the northeast–southwest drift around the northern and western coasts attains its highest velocity and its most definitely long-shore character, and is most definitely continued southward past Cape Cod. It also involves Massachusetts Bay, not only crossing the mouth of the latter, but also skirting its coastline from north to south, and so out again past Cape Cod. Under these circumstances flotsam of any kind (buoyant fish eggs, for instance, or the larvæ hatched therefrom) that may drift from the north into the northern side of Massachusetts Bay, or that may be produced there, tends to drift out of its southern side.

This long-shore movement (involving Massachusetts Bay) may continue, little altered, into the summer; but some time between May and July the heavy center again shifts eastward, and in some years, at least, this center becomes divided into the two lows recorded for the summer of 1914—the one in the offing of the Bay of Fundy, the other in the region of the Eastern Channel. This completes the yearly cycle.

On the bottom the water moves inward along the eastern side of the Eastern Channel during the early spring, and at other times of year in pulses not yet understood, usually outward along the western side. At depths of 150 meters, or deeper, the general tendency within the basin is northward along the eastern (Nova Scotian) slope the year round, veering through west to southwest across the basin toward the offing of Massachusetts Bay; and though variations in salinity and temperature prove this drift intermittent, its stream track seems comparatively constant from season to season during its periods of activity.

The correspondence between the dominant circulation of the gulf, as established by direct evidence, and the dynamic gradient is close enough to show that the former is essentially dynamic, set in motion by the regional inequalities in density, but given its eddylike character by the confining effect of the bottom contour of Georges Bank to the south.

Deflection of the horizontal tidal oscillations by the rotation of the earth similarly tends to produce an anticlockwise movement around the basin of the gulf, and with the effect of the wind consistent with this, the several motive forces are parallel in effect.

The westerly drift of slope water along the slope of the continent is also dynamic in source, and available evidence suggests the same motive power for the "Gulf Stream" drift abreast of the gulf.

TABLES OF TEMPERATURE, SALINITY, AND DENSITY

Temperature is in degrees Centigrade, salinity in parts per mille, and density is at the temperature *in situ* but without correction for compression. The tables on page 977, summarized from Ekman's (1910) tables 2, 4, and 5, give a close enough approximation to the latter for general purposes in depths as small as those of the Gulf of Maine. For computations involving the specific volume, Smith's (1926, p. 19) simplification of Hesselberg and Sverdrup's (1915) tables are to be preferred.

STANDARDS OF ACCURACY

The old type reversing thermometers used in 1912 and 1913 were accurate only to within about ±0.15° C., but with the instruments used subsequently for the subsurface readings the probable error in temperature determination is less than 0.05° C. As the surface readings have often been taken under difficulties and by various persons, accuracy is not claimed for them beyond about ±0.3° C.

All the determinations of salinity, except some for the winter of 1925 (noted below under the respective stations), have been by titration. So far as personal and instrumental errors are concerned, the results are reliable considerably within the requirements of the International Committee for the Exploration of the Sea—probably to ±0.03 per mille of salinity. However, as Giral (1926) has recently emphasized, regional or seasonal variations in the relative proportions of the various solutes in sea water, such as are known to occur, introduce another source of error, which makes it unsafe to claim accuracy closer than about 0.05 per mille even for waters as nearly uniform in their saline content as the Gulf of Maine probably is.

The accuracy of the calculated densities depends, of course, on that of the determinations of temperature and salinity on which they are based; and while errors in these two may partially offset each other, they may, on the contrary, be cumulative. Allowing as the probable range of error 0.05° and ±0.3 per mille, the probable error for the densities will average less than ±0.04 units when the salinity has been deter mined by titration. In the case of hydrometer readings, the probable error of the densities will be about ±0.1 unit.

All depths, whether originally recorded in meters or fathoms, are given in meters in these tables. Tables 1, 2, and 3 show the compression of sea water as condensed from Ekman's (1910) tables 2, 4, and 5.[99]

TABLE 1.—*Correction of density for depth—water 0° and 28 in density (sp. gr. 1.028)*

Depth, meters	Increase in density	Depth, meters	Increase in density	Depth, meters	Increase in density	Depth, meters	Increase in density
10	0.05	80	0.38	200	0.97	700	3.35
20	.10	90	.43	250	1.20	800	3.83
30	.14	100	.48	300	1.42	900	4.30
40	.19	120	.57	400	1.93	1,000	4.78
50	.24	140	.67	500	2.40	1,100	5.25
60	.29	160	.76	600	2.88	1,200	5.72
70	.33	180	.87				

TABLE 2.—*Additional corrections for compression at other temperatures*

Depth	Add	Subtract																	
	−1°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	13°	14°	15°	16°	17°	18°
50							0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02
100					0.01	0.01	.01	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02
200	0.01	0.01	0.01	0.02	.02	.03	.03	.04	.04	.05	.05	.05	.06	.06	.07	.07	.07	.08	.08
300	.01	.01	.02	.02	.03	.04	.05	.06	.06	.07	.08	.08	.09	.09	.10	.10			
400	.01	.01	.02	.03	.04	.05	.06	.07	.08	.09	.10	.11	.12	.12	.13	.14			
500	.01	.01	.03	.04	.05	.07	.08	.09	.10	.11	.12	.14	.15	.15	.16				
600	.02	.02	.03	.05	.07	.08	.10	.11	.12	.14	.15	.16	.16	.18					
700	.02	.02	.04	.06	.08	.10	.11	.13	.14	.16	.17	.19	.20						
800	.02	.02	.05	.07	.09	.11	.13	.15	.16	.18	.20								
900	.03	.03	.05	.07	.10	.12	.14	.16	.18	.20	.22								
1,000	.03	.03	.06	.08	.11	.13	.16	.18	.20	.23	.25								
1,100	.03	.03	.06	.09	.12	.15	.17	.20	.22										
1,200	.03	.03	.07	.10	.13	.16	.19	.22	.24										

TABLE 3.—*Additional corrections for compression at other densities*

Depth	Density							
	Subtract						Add	
	22	23	24	25	26	27	29	30
100	0.01	0.01						
200	.01	.01	0.01	0.01				
300	.02	.02	.01	.01	0.01			0.01
400	.02	.02	.02	.01	.01			.01
500	.03	.02	.02	.02	.01			.01
600	.04	.03	.03	.02	.01	0.01	0.01	.01
700	.04	.04	.03	.02	.01	.01	.01	.01
800	.05	.04	.03	.03	.02	.01	.01	.02
900	.06	.05	.04	.03	.02	.01	.01	.02
1,000	.06	.05	.04	.03	.02	.01	.01	.02
1,100	.07	.06	.05	.04	.02	.01	.01	.02
1,200	.08	.06	.05	.04	.03	.01	.01	.03

[99] Condensation of the tables entails employing an average relationship between meters and decibars. Consequently, they are accurate only to ±2 in the last decimal place. This, however, falls within the accuracy of observation and will suffice for the construction of all ordinary projections of density in water so shoal.

TABLE 4.—*Temperatures, salinities, and densities, "Grampus" stations, 1912*

Station	Date, 1912	Position	General locality	Depth	Temperature	Salinity	Density
10001	July 9	° 42 30 N. 70 34 W.	Off Gloucester	0	17.78	32.07	23.05
				60	5.00		
				64		32.65	[1]25.83
10002	July 10	42 32 N. 70 23 W.	Offing of Gloucester	0	18.33	31.74	22.68
				18	9.56		
				64	4.61		
				73		32.77	[1]25.97
				110	4.61		
				118		32.92	[1]26.09
10003	do	42 37 N. 70 22 W.	7½ miles off Cape Ann	0	18.89		
				46	5.05		
10005	July 12	42 32 N. 70 36 W.	3½ miles off Eastern Point, Gloucester	0	16.28	31.67	23.23
				49	5.17		
				55		32.57	[1]25.76
10006	July 13	42 22 N. 70 43 W.	Off Boston Harbor	0	16.11	31.96	23.45
				18	6.28		
				46		32.52	[1]25.70
				49	5.17		
10007	July 15	42 44 N. 69 50 W.	Offing of Cape Ann	0	17.78	31.62	22.71
				46	7.39		
				91	4.61		
				137	4.61	33.49	26.54
				229	4.61	33.78	26.77
10008	July 16	42 45 N. 70 39 W.	North of Cape Ann	0	16.11		
				37		32.39	[1]25.70
				40	5.78		
10009	do	42 49 N. 70 28 W.	Offing of Merrimac River	0	19.72	31.44	22.22
				91	4.44	32.84	26.05
10011	July 17	43 04 N. 70 20 W.	Near Isles of Shoals	0	15.00	31.92	23.64
				27	7.17		
				46		32.61	
				55	5.17		
				82	4.61		
				110	4.61	32.85	26.94
				146		33.04	
10012b	July 23	42 53 N. 70 20 W.	Southeast from Isles of Shoals	0	13.89	31.92	23.85
				146	4.11		
10014	July 24	43 19 N. 70 13 W.	Offing of Kennebunkport	0	13.89	31.08	23.19
				9	12.89		
				27	6.89		
				46	6.28		
10015	July 25	43 37 N. 70 00 W.	Mouth of Casco Bay	0	14.44	31.26	23.23
				9	12.50		
				18	10.78		
				37	7.50		
				55	6.89	32.88	25.78
10016	July 26	43 42 N. 69 42 W.	Near Seguin Island	0	13.89	31.20	23.29
				9	12.00		
				18	10.78		
				27	8.72		
				37	7.44	32.14	25.13
10019	July 29	43 30 N. 69 48 W.	Offing of Casco Bay	0	13.89	31.92	23.89
				37	8.50		
				55	7.56		
				73	5.89		
				91	5.67	32.97	26.01
10021	Aug. 2	43 38 N. 69 13 W.	Off Monhegan Island	0	13.05	32.43	23.21
				27	9.22		
				55	8.17		
				82	7.50		
				110	7.22	32.94	25.78
10022	Aug. 7	43 26 N. 70 04 W.	Offing of Cape Elizabeth	0	16.67		
				82	7.95	32.74	25.53

[1]Approximate only.

TABLE 4.—*Temperatures, salinities, and densities, "Grampus" stations, 1912*—Continued

Station	Date, 1912	Position	General locality	Depth	Temperature	Salinity	Density
10023	Aug. 7	43° 10′ N. 69° 40′ W.	Platts Bank	0	17.78	32.52	23.41
				27	8.61	-----	-----
				46	7.33	-----	-----
				64	5.61	-----	-----
				82	4.89	33.30	26.36
10025	Aug. 8	43 26 N. 68 49 W.	Offing of Penobscot Bay	0	13.33	32.34	24.26
				18	9.56	-----	-----
				37	9.56	-----	-----
				55	9.11	-----	-----
				73	8.22	-----	-----
				101	7.89	33.22	25.91
10026	...do...	43 40 N. 69 02 W.	...do	0	13.89	-----	-----
				118	7.67	33.13	25.87
10027	Aug. 14	43 26 N. 68 06 W.	South of Mount Desert Island	0	15.00	32.66	24.21
				46	7.78	-----	-----
				91	7.22	33.64	26.35
				137	6.28	-----	-----
				183	6.00	33.89	26.69
10028	...do...	43 26 N. 67 20 W.	East side of basin	0	15.00	32.75	24.28
				18	10.39	-----	-----
				37	8.72	-----	-----
				55	7.56	-----	-----
				101	7.39	-----	-----
				146	7.39	-----	-----
				183	7.39	-----	-----
				219	7.39	34.54	27.02
10029	...do...	43 26 N. 66 25 W.	German Bank	0	10.44	32.70	25.19
				18	9.83	-----	-----
				37	9.67	-----	-----
				55	9.67	-----	-----
				64	9.61	32.92	25.41
10031	Aug. 15	43 45 N. 66 55 W.	West of Lurcher Shoal	0	13.33	32.84	24.65
				37	11.50	-----	-----
				73	10.22	-----	-----
				110	8.17	-----	-----
				137	7.67	33.82	26.41
10032	Aug. 16	43 56 N. 67 58 W.	Near Mount Desert Rock	0	13.89	32.51	24.30
				165	-----	34.13	-----
10033	...do...	44 25 N. 67 30 W.	Off Machias, Me	0	10.6	32.68	25.09
				9	10.4	-----	-----
				27	9.83	-----	-----
				46	9.67	-----	-----
				64	9.61	32.68	25.22
10034	Aug. 17	44 50 N. 66 53 W.	Grand Manan Channel, off Campobello	0	10.00	-----	-----
				18	9.83	-----	-----
				46	9.83	-----	-----
				73	9.61	-----	-----
				101	9.56	32.68	25.23
10035	Aug. 19	44 36 N. 67 11 W.	Off Cutler, Me	0	10.56	32.57	25.00
				18	9.78	-----	-----
				37	9.78	-----	-----
				55	9.78	-----	-----
				73	9.72	-----	-----
				82	-----	32.65	25.10
10036	Aug. 20	44 16 N. 67 23 W.	Offing of Machias, Me	0	11.39	32.75	24.98
				37	9.56	-----	-----
				110	8.22	-----	-----
				146	7.61	-----	-----
				183	7.44	34.31	26.84
10037	Aug. 21	44 17 N. 68 05 W.	Off Frenchmans Bay	0	12.78	-----	-----
				18	10.50	-----	-----
				37	9.89	-----	-----
10038	...do...	43 51 N. 68 33 W.	Offing of Penobscot Bay	0	13.05	32.32	24.37
				37	9.95	-----	-----
				55	9.28	-----	-----
				73	9.05	-----	-----
				91	9.05	32.95	25.52
10039	Aug. 22	43 37 N. 69 01 W.	...do	0	13.33	-----	-----
				37	9.44	-----	-----
				73	8.89	-----	-----
				110	8.33	-----	-----
				146	7.11	33.37	26.14

TABLE 4.—*Temperatures, salinities, and densities, "Grampus" stations, 1912*—Continued

Station	Date, 1912	Position	General locality	Depth	Temperature	Salinity	Density
		° ′					
10041	Aug. 24	43 06 N. 70 12 W.	Off Isles of Shoals	0	16.11	32.07	23.54
				146	4.61		
10043	Aug. 29	42 11 N. 69 53 W.	Offing of northern Cape Cod	0	15.56	32.39	23.89
				37	10.50		
				73	8.05	33.15	25.83
				110	5.56		
				146	5.17		
				174	5.17	33.69	26.64
10044	Aug. 31	42 09 N. 70 22 W.	Massachusetts Bay, north of Cape Cod	0	14.44	32.03	23.84
				18	11.50		
				37	7.72		
				55	6.83	32.52	25.47
10045	...do	42 20 N. 70 36 W.	Mouth of Massachusetts Bay	0	16.11	31.92	23.42
				37	8.72		
				55	7.17		
				73	6.17	32.89	25.88
10046	...do	42 30 N. 70 39 W.	Massachusetts Bay off Gloucester	0	16.11	31.67	23.22
				55	6.83	32.56	25.54
10047[1]	Nov. 20	42 27 N. 70 40 W.	7 miles south (true) from Gloucester harbor mouth	0	9.17	32.57	25.21
				46	9.00	32.57	25.24
				62	9.00	32.66	25.30
10048[1]	Dec. 4	42 26 N. 70 40 W.	...do	0	8.11	32.56	25.36
				46	7.83	32.56	25.40
				70	7.83	32.61	25.45
10049[1]	Dec. 23	42 26 N. 70 40 W.	...do	0	6.95	32.74	25.66
				42	6.95	32.75	25.68
				70	6.95	32.75	26.68

[1] Stations occupied by steamer Bluewing.

TABLE 5.—*Temperatures and salinities, Massachusetts Bay to Georges Bank, April, 1913*

Date	Latitude	Longitude	Depth, meters	Temperature	Salinity
	° ′	° ′			
Apr. 11	41 47	67 18	0		33.22
14	41 37	67 18	0	6.7	33.21
			46	6.1	
15	41 52	66 45	0		33.33
15	42 03	67 01	0		33.22
15	42 08	67 12	0		33.38
15	42 14	67 28	0	6.7	
			128	5.28	
26	42 20	70 45	0		31.51
26	42 08	70 10	0		32.29
27	41 48	69 21	0		33.13
27	41 34	68 45	0		33.25
27	41 27	68 20	0	7.8	33.16
			64	6.7	33.21

TABLE 6.—*Observations by W. W. Welsh, April and May, 1913*

Station	Date	Position	General locality	Depth	Temperature	Salinity	Density
		° ′					
1	Mar. 19	42 31 N. 70 29 W.	Off Gloucester	0	3.90	33.01	26.23
				88	3.90	33.17	26.36
2		42 35 N. 70 28 W.	...do	0	3.95	32.84	26.10
				119	3.78	33.17	26.37
4		42 51 N. 70 20 W.	Off Merrimac River	0	4.00	32.61	25.91

TABLE 6.—*Observations by W. W. Welsh, April and May, 1913*—Continued

Station	Date	Position	General locality	Depth	Temperature	Salinity	Density
5	Mar. 29	43° 12′ N., 70° 25′ W.	Near Boon Island	0	3.50	32.45	25.83
				31	3.72	32.83	26.11
				64	3.83	32.99	26.23
7	Apr. 4	43° 13′ N., 70° 24′ W.	do	0	3.90	32.77	26.04
8	Apr. 5	43° 10′ N., 70° 28′ W.	do	0	3.90	32.74	26.02
				26	3.78	32.81	26.09
				51	3.90	33.04	26.26
				59	----------	33.04	26.26
9	Apr. 9	43° 24′ N., 70° 20′ W.	Off Wood Island	0	3.83	29.57	23.46
				16	3.95	30.79	24.46
				33	4.05	31.00	24.63
10	Apr. 10	43° 23′ N., 70° 21′ W.	do	0	3.44	26.74	21.30
				18	4.05	31.80	25.20
				38	4.00	32.52	25.84
11	Apr. 13	42° 57′ N., 70° 39′ W.	Near Isles of Shoals	0	4.50	31.56	25.03
				18	4.11	32.43	25.76
				37	4.05	32.66	25.94
12	Apr. 14	43° 18′ N., 70° 26′ W.	Off Cape Porpoise	0	4.56	29.13	23.09
				18	4.17	31.92	25.35
				37	3.90	32.47	25.81
13	Apr. 16	42° 55′ N., 70° 41′ W.	Near Isles of Shoals	0	5.05	30.66	24.26
				20	4.67	31.47	24.95
				55	4.05	32.52	25.83
14	Apr. 18	42° 50′ N., 70° 41′ W.	Off Merrimac River	0	5.00	30.79	24.37
				18	4.72	30.97	24.58
				44	4.05	32.47	25.79
15	Apr. 20	42° 55′ N., 70° 45′ W.	Off Hampton	0	4.67	31.11	----------
16	Apr. 22	42° 55′ N., 70° 37′ W.	Near Isles of Shoals	0	4.83	31.43	24.89
				18	4.44	31.71	25.15
				46	4.05	32.80	26.05
17	Apr. 23	42° 59′ N., 70° 39′ W.	do	0	5.11	30.93	24.47
				11	4.67	31.53	24.98
				27	4.05	32.56	25.86
18	Apr. 25	43° 12′ N., 70° 27′ W.	Near Boon Island	0	6.67	31.76	24.94
				27	4.05	32.46	25.78
				55	4.06	32.65	25.94
19	Apr. 26	43° 00′ N., 70° 35′ W.	Near Isles of Shoals	0	7.95	30.03	23.40
				27	4.00	32.45	25.78
				64	4.00	32.74	26.01
20	Apr. 29	43° 02′ N., 70° 35′ W.	do	0	7.11	31.51	24.69
				27	4.05	32.33	25.68
				64	4.00	32.72	26.00
21	May 1	42° 57′ N., 70° 38′ W.	do	0	6.56	30.66	24.08
				48	4.05	32.48	25.80
22	May 2	42° 57′ N., 70° 40′ W.	do	0	7.22	30.64	23.99
23	May 3	42° 54′ N., 70° 42′ W.	Off Hampton	0	8.11	29.92	23.31
				20	6.00	31.56	24.87
				46	4.05	32.49	25.80
24	May 5	42° 54′ N., 70° 42′ W.	do	0	9.05	29.54	22.87
				22	5.17	31.95	25.27
				48	4.11	32.50	25.81
25	May 6	42° 56′ N., 70° 41′ W.	do	0	9.78	29.60	22.80
				46	4.11	32.52	25.83
26	May 8	42° 56′ N., 70° 41′ W.	do	0	8.22	29.93	23.29
				9	7.33	----------	----------
				18	5.44	----------	----------
				44	4.17	32.30	25.65

TABLE 6.—*Observations by W. W. Welsh, April and May, 1913*—Continued

Station	Date	Position	General locality	Depth	Temperature	Salinity	Density
27	May 10	42° 56′ N. 70° 44′ W.	Off Hampton	0	7.56	30.44	23.79
				20	5.56	----	----
				40	4.11	32.46	25.78
28	May 12	42 56 N. 70 44 W.	do	0	7.17	30.73	24.06
				18	5.67	----	----
				37	----	32.18	----
29	May 13	42 56 N. 70 44 W.	do	0	7.28	30.88	24.16
				22	5.33	----	----
				44	4.22	32.33	25.67
30	May 14	42 58 N. 70 35 W.	Near Isles of Shoals	0	8.11	30.50	23.75
				27	5.28	32.62	----
				53	4.39	----	25.88
31	May 16	42 56 N. 70 42 W.	Off Hampton	0	8.17	30.94	24.09
				48	----	32.39	25.52
32	May 17	42 32 N. 70 44 W.	North side, Massachussetts Bay, off Bakers Island	0	8.50	30.95	24.05
				16	7.28	31.25	24.46

TABLE 7.—"*Grampus*" *stations, 1913*

Station	Date	Position	General locality	Depth	Temperature	Salinity	Density
10050[1]	Jan. 16	42° 26′ 00″ N. 70° 40′ 00″ W.	7 miles south (true) from Gloucester Harbor mouth	0	5.39	32.81	25.91
				46	5.28	32.86	25.93
				70	5.61	32.94	25.99
10051[1]	Jan. 30	42 33 00 N. 70 41 00 W.	4 miles south (true) from Gloucester Harbor mouth	0	4.72	32.56	25.79
				18	4.83	----	----
				35	5.39	32.82	25.93
10052[1]	do	42 43 00 N. 70 39 00 W.	Ipswich Bay	0	4.61	32.20	25.52
				15	4.83	----	----
				33	5.33	32.90	25.99
10053[1]	Feb. 13	42 37 00 N. 70 30 00 W.	4 miles south, 70° east, from Cape Ann	0	2.83	32.83	26.19
				46	2.78	32.83	26.20
				82	3.11	32.84	26.18
10054[1]	Mar. 4	42 33 30 N. 70 30 00 W.	6 miles south, 32° east, from Thatchers Island	0	2.89	32.85	26.20
				46	3.05	32.96	26.27
				82	3.61	33.04	26.29
10055[1]	Apr. 3	42 33 00 N. 70 30 00 W.	do	0	4.05	32.32	25.68
				18	4.05	----	----
				37	4.05	----	----
				46	----	33.03	26.24
				55	4.00	----	----
				77	3.95	33.12	26.32
10056[1]	Apr. 14	42 33 00 N. 70 39 30 W.	2 miles south from Gloucester Harbor mouth	0	5.56	31.11	24.56
				46	4.11	32.79	26.05
10057	July 8	42 06 00 N. 69 56 00 W.	Off northern Cape Cod	0	16.11	31.90	23.43
				18	10.33	31.97	24.55
				37	5.89	32.48	25.59
				55	----	32.70	----
				73	5.11	32.68	25.84
10058	do	41 47 00 N. 69 10 00 W.	Offing of southern Cape Cod	0	17.22	32.40	23.53
				55	5.05	33.10	26.18
				110	4.78	33.35	26.40
				165	5.17	33.36	26.38
10059	July 9	41 06 00 N. 68 42 00 W.	Northwest part of Georges Bank	0	13.33	33.06	24.93
				27	12.61	33.07	24.99
				55	12.61	33.13	25.04
10060	do	40 41 00 N. 69 33 00 W.	5 miles northeast of Nantucket Lightship	0	16.11	32.63	23.94
				18	14.11	32.68	24.40
				46	10.17	33.04	25.41

[1] Stations occupied by steamer Bluewing.

TABLE 7.—"*Grampus*" *stations, 1913*—Continued

Station	Date	Position (° ′ ″)	General locality	Depth	Temperature	Salinity	Density
10061	July 10	40 00 00 N. 69 29 00 W.	Continental edge S. 8° E. Nantucket Shoals Lightship	0	20.00	33.41	23.55
				46	8.83	33.51	26.00
				91	8.50	33.62	26.14
10062	...do....	40 29 00 N. 70 29 00 W.	Offing of Marthas Vineyard	0	19.44	32.86	23.42
				37	7.89	33.04	25.77
				73	6.44	33.44	26.28
10085	Aug. 4	41 39 00 N. 69 42 00 W.	Off Chatham, Cape Cod	0	17.50	32.05	23.15
				18	6.44	32.47	25.51
				48	5.83	32.56	25.66
10086	Aug. 5	42 06 00 N. 70 00 00 W.	Off northern Cape Cod. Same locality as No. 10057	0	17.11	32.09	23.30
				18	11.72	32.23	24.51
				37	6.56	32.52	25.54
				55	6.28	32.52	25.58
				73	6.22	32.52	25.59
10087	Aug. 9	42 31 00 N. 70 21 00 W.	Mouth of Massachusetts Bay, off Gloucester	0	16.67	32.09	23.41
				18	10.78	----------	----------
				37	----------	32.68	----------
				46	6.05	----------	----------
				91	5.17	32.77	25.91
				128	5.17	32.75	25.90
10088	...do....	42 33 00 N. 69 33 00 W.	Basin in offing of Cape Ann	0	19.17	32.21	22.91
				46	7.72	----------	----------
				91	5.17	33.17	26.22
				183	6.28	33.87	26.64
				274	6.33	34.27	26.96
10089	Aug. 10	43 02 00 N. 69 19 00 W.	52 miles southeasterly from Cape Elizabeth	0	16.39	32.52	23.88
				18	12.05	----------	----------
				46	6.67	32.95	25.86
				91	6.67	33.26	26.10
				183	5.12	33.46	26.46
10090	...do....	42 51 00 N. 68 25 00 W.	Near Cashes Ledge	0	16.11	32.56	23.91
				18	11.17	----------	----------
				46	6.78	32.92	25.83
				91	6.39	33.21	26.11
				183	6.61	33.84	26.57
10091	Aug. 11	43 24 00 N. 68 49 00 W.	Offing of Penobscot Bay	0	16.11	32.47	23.84
				18	14.50	32.57	24.22
				46	8.61	----------	----------
				91	6.72	----------	----------
				110	----------	33.40	[1] 26.20
10092	...do....	43 27 00 N. 67 55 00 W.	Basin in offing of Mount Desert Rock	0	16.67	32.59	24.05
				18	11.44 9.22	----------	----------
				46	6.22	33.10	26.04
				73–82	5.56	----------	----------
				91	5.83	33.28	26.23
				183	6.11	33.91	26.70
				238	6.05	34.14	26.81
10093	Aug. 12	43 24 00 N. 67 12 00 W.	East side of basin off German Bank	0	15.83	32.61	23.95
				18	14.50	----------	----------
				37	10.67	----------	----------
				55	----------	32.95	----------
				91	5.56	----------	----------
				110	----------	33.58	[1] 26.50
				137	5.89	----------	----------
				219	5.89	34.10	26.86
10094	...do....	43 25 00 N. 66 43 00 W.	Western slope of German Bank	0	8.89	32.75	25.46
				18	8.33	----------	----------
				37	----------	33.01	25.69
				46	8.33	----------	----------
				73	----------	33.24	[1] 25.88
				91	8.17	----------	----------
				113	7.17	33.62	26.32
10095	...do....	43 20 00 N. 66 27 00 W.	German Bank	0	8.89	32.75	25.43
				9	8.78	----------	----------
				18	8.67	32.92	25.56
				55	8.56	32.94	25.59

[1] Approximately

TABLE 7.—"*Grampus*" *stations, 1913*—Continued

Station	Date	Position	General locality	Depth	Temperature	Salinity	Density
10096	Aug. 12	43° 56′ 00″ N. 66° 50′ 00″ W.	Off Lurcher Shoal	0	12.22	32.75	24.89
				18	10.95		
				46	9.67		
				55		33.42	
				91	8.44		
				110		33.39	
				119	6.11		
10097	Aug. 13	44 13 00 N. 67 21 00 W.	Northeast end of basin off Bay of Fundy	0	12.78	32.75	24.80
				18	11.67		
				55		32.77	
				91	8.00		
				201	6.00	34.09	26.85
10098	...do...	44 24 00 N. 67 29 00 W.	Off Machias, Me.	0	10.28	32.47	25.01
				18	9.56		
				27		32.59	
				68	9.05	32.70	25.64
10099	...do...	44 08 00 N. 68 10 00 W.	4 miles west of Great Duck Island, off Mount Desert.	0	12.78	32.38	24.39
				37	9.33	32.61	25.33
10100	...do...	43 52 00 N. 67 58 00 W.	Off Mount Desert Rock.	0	12.78	32.75	24.67
				18	10.11		
				37		32.95	
				46	8.50		
				91	7.78	33.28	25.98
				183	6.22	33.87	26.65
10101	Aug. 14	43 44 00 N. 68 44 00 W.	Offing of Penobscot Bay	0	11.95	32.68	24.83
				18	10.11		
				37		32.92	
				46	9.28		
				91	8.50	33.26	25.86
10102	...do...	43 34 00 N. 69 13 00 W.	12 miles S. 20° E. from Monhegan Island Light	0	16.11	32.23	23.65
				18	9.56		
				37		32.66	
				46	8.72		
				91	7.44		
				128		33.17	[1]26.20
				137	5.89		
10103	...do...	43 32 00 N. 69 55 00 W.	Off Casco Bay	0	16.11	31.83	23.35
				18	11.39		
				37		32.63	
				46	8.05		
				91	6.72	32.83	25.76
10104	Aug. 15	43 08 00 N. 70 06 00 W.	Trough west of Jeffreys Ledge, off Boon Island	0	17.22	31.85	23.14
				18	9.61		
				37		32.57	
				46	7.33		
				91	5.50	33.06	26.10
				146		33.10	
				155	4.33		
10105	...do...	42 48 00 N. 70 27 00 W.	Trough west of Jeffreys Ledge, off Ipswich	0	17.78	32.09	23.18
				18	9.83		
				46	6.89		
				55		32.66	
				91	5.33		
				110	4.61	32.74	25.95
10106	Aug. 20	42 29 00 N. 70 37 00 W.	Mouth of Massachusetts Bay, 6 miles off Gloucester Harbor mouth.	0	16.11	32.16	23.59
				27	9.17	32.41	25.08
				69	6.72	32.57	25.56
10112	Aug. 22	40 17 00 N. 70 57 00 W.	Offing of Marthas Vineyard, 60 miles	0	20.83	34.00	24.02
				37	17.22		
				64	15.67	34.83	25.71
				110	15.44	35.17	26.02

[1] Approximately

TABLE 8.—"*Grampus*" stations, 1914

Station	Date	Position	General locality	Depth	Temperature	Salinity	Density
10213	July 19	42° 11′ N., 69° 59′ W.	Off Northern Cape Cod	0	16.83	31.17	22.6
				20	9.06	------	------
				40	5.38	32.34	------
				100	3.97	32.74	26.05
				120	------	32.95	------
				130	4.41	------	------
10214	do	41° 49′ N., 69° 21′ W.	Basin, off Chatham, Cape Cod	0	17.5	31.80	23.12
				20	15.75	------	------
				40	7.25	32.25	25.24
				100	4.22	32.92	26.13
				150	5.12	33.28	------
				190	5.53	33.49	26.44
10215	July 20	41° 19′ N., 68° 42′ W.	Northwest part, Georges Bank	0	16.68	32.09	23.53
				20	12.24	------	------
				40	10.43	32.81	25.19
				70	9.62	32.88	25.38
10216	do	40° 38′ N., 68° 20′ W.	Southwest part, Georges Bank	0	18.60	33.10	23.87
				20	13.90	------	------
				40	13.04	33.58	25.30
				70	10.64	34.88	26.76
10217	July 21	40° 20′ N., 68° 13′ W.	Southwest slope, Georges Bank	0	17.3	32.74	23.82
				20	10.64	------	------
				40	9.15	33.60	26.01
				100	11.80	------	------
				150	10.63	35.23	27.04
10218	do	40° 06′ N., 68° 06′ W.	Continental slope, southwest of Georges Bank	0	20.48	34.42	24.37
				40	17.70	36.04	26.16
				100	14.87	35.82	26.65
				200	10.85	35.32	------
				300	9.46	35.14	27.07
				400	------	34.96	------
				500	5.25	34.90	27.59
10219	do	40° 39′ N., 67° 28′ W.	Southern slope of Georges Bank	0	18.90	33.55	23.68
				20	17.33	------	------
				40	16.00	------	------
				90	10.28	34.65	26.65
10220	July 22	40° 54′ N., 66° 13′ W.	Continental slope, southeast of Georges Bank	0	19.98	33.82	23.94
				40	15.35	34.97	25.89
				100	11.20	35.23	26.93
				200	8.18	35.01	27.27
				300	6.90	34.94	27.41
				400	5.55	34.87	27.52
				500	5.02	34.87	27.59
10221	do	41° 07′ N., 66° 20′ W.	Southeast slope of Georges Bank	0	16.50	32.74	24.05
				40	16.18	34.78	25.52
				100	12.00	35.16	26.74
				160	10.78	35.25	27.03
10222	do	41° 20′ N., 66° 19′ W.	Southeast edge of Georges Bank	0	14.67	32.48	24.28
				90	8.98	34.18	26.50
10223	July 23	41° 35′ N., 66° 37′ W.	Southeast part of Georges Bank	0	13.33	32.59	24.57
				20	10.86	32.63	24.97
				40	8.90	32.78	25.41
				75	7.92	33.03	25.76
10224	do	42° 03′ N., 66° 57′ W.	Northeast part of Georges Bank	0	11.11	32.47	24.84
				30	10.76	32.54	24.92
				55	10.78	32.61	24.97
10225	do	42° 22′ N., 67° 11′ W.	Southeast part of basin north of Georges Bank	0	15.28	32.16	23.81
				40	10.00	33.17	25.54
				100	9.53	34.69	26.80
				150	9.33	35.05	27.12
				200	8.40	35.08	27.29
				250	7.93	35.08	27.36
10226	July 24	42° 08′ N., 66° 14′ W.	Northeast edge of Georges Bank	0	15.28	32.25	23.88
				40	12.60	32.34	24.43
				85	6.60	33.03	25.94

TABLE 8.—"*Grampus*" *stations, 1914*—Continued

Station	Date	Position	General locality	Depth	Temperature	Salinity	Density
10227	July 24	42° 19′ N. 66° 02′ W.	Eastern Channel between Georges and Browns Banks	0	15.11	32.47	24.06
				40	9.30	33.04	25.55
				80	8.91	34.18	26.90
				130	8.80	34.78	27.00
				170	7.15	34.99	27.41
				220	6.95	35.03	27.47
10228	...do....	42 34 N. 65 51 W.	Browns Bank	0	14.72	32.20	23.90
				40	8.35	33.40	25.99
				85	8.50	34.25	26.63
10229	July 25	42 55 N. 65 41 W.	Northern Channel	0	11.44	32.01	24.39
				40	6.17	32.38	25.48
				100	5.96	32.92	25.93
10230	...do....	43 19 N. 65 23 W.	Offing of Cape Sable	0	10.28	31.47	24.17
				30	3.03	32.07	25.56
				50	3.14	32.34	25.77
10231	July 27	43 37 N. 64 57 W.	Profile off Shelburne, Nova Scotia	0	6.62	31.62	24.85
				30	1.81	31.98	25.59
				50	1.91 1.97	32.20	25.71
10232	July 28	43 12 N. 64 27 W.	...do	0	15.00	31.26	32.12
				40	4.38	31.74	25.23
				100	2.88 3.45	32.88	-----
				140	5.55 5.76	33.64	26.54
10233	...do....	42 41 N. 63 58 W.	...do	0	16.95	31.22	22.85
				40	7.34	32.96	25.80
				100	7.59	34.16	26.69
				200	7.74	-----	-----
				300	7.62	34.96	27.31
				400	5.30	34.92	27.59
				500	4.98	34.83	27.57
10243	Aug. 11	43 18 N. 65 27 W.	Offing of Cape Sable	0	13.61	31.67	23.72
				30	7.47	31.67	24.75
				55	3.51	31.98	25.45
10244	Aug. 12	43 22 N. 66 26 W.	German Bank	0	10.00	32.84	25.28
				30	9.64	32.86	25.36
				55	9.60	32.90	25.39
10245	...do....	43 49 N. 66 51 W.	West of Lurcher Shoal	0	14.44	32.52	24.20
				40	9.44	33.42	25.83
				80	8.75	33.87	26.29
				120	8.54	34.11	26.51
10246	...do....	44 15 N. 67 23 W.	Basin in offing of Machias, Me	0	14.44	33.06	24.61
				40	8.35	33.35	25.95
				100	6.28	33.57	26.41
				150	7.58	34.05	26.68
				190	8.17	34.47	26.85
10247	...do....	44 21 N. 67 28 W.	Off Machias, Me	0	10.44	32.52	24.96
				30	8.97	-----	-----
				60	8.88	32.84	25.47
10248	Aug. 13	43 46 N. 67 58 W.	Off Mount Desert Rock	0	13.33	32.65	24.52
				40	8.45	32.97	25.63
				100	7.18	33.51	26.24
				150	6.04	33.64	26.49
				190	8.34	34.49	26.84
10249	...do....	43 17 N. 67 40 W.	Eastern part of basin	0	17.50	31.91	23.06
				40	6.38	32.74	25.74
				100	5.31	33.06	26.12
				150	6.04	33.55	26.41
				220	5.83	33.48	26.41
10250	Aug. 14	43 39 N. 68 49 W.	Offing of Penobscot Bay	0	13.05	32.52	24.48
				40	8.59	32.92	25.57
				100	7.04	33.24	26.04
				145	6.26	33.39	26.27

TABLE 8.—"*Grampus*" *stations, 1914*—Continued

Station	Date	Position	General locality	Depth	Temperature	Salinity	Density
10251	Aug. 14	43° 27′ N. 69° 39′ W.	Offing of Casco Bay	0	16.56	31.92	23.28
				40	5.65	32.38	25.55
				100	4.41	32.70	25.98
				145	4.93	33.24	26.31
10252	Aug. 15	42 57 N. 70 18 W.	Off Isles of Shoals	0	16.22	31.64	23.15
				40	7.80	32.39	25.27
				90	4.64	32.56	25.80
				130	3.66	32.79	26.09
10253	Aug. 22	42 29 N. 70 18 W.	Offing of Gloucester	0	18.89	31.29	22.19
				40	6.47	32.29	25.37
				100	4.64	32.43	25.70
				140	4.49	32.50	25.77
10254	...do...	42 37 N. 69 38 W.	Basin, offing of Cape Ann	0	20.00	31.55	22.13
				40	5.75	32.43	25.57
				100	4.36	----	----
				150	5.51	33.42	26.37
				200	6.80	34.11	26.56
				260	7.09	34.23	26.82
10255	Aug. 23	42 27 N. 68 30 W.	Central part of basin	0	19.17	31.89	22.62
				40	7.81	32.52	25.37
				100	3.95	32.81	26.07
				150	5.13	33.33	26.35
				175	6.24	33.87	26.65
10256	...do...	41 55 N. 69 25 W.	Southwest part of basin, offing of Cape Cod	0	19.56	31.80	22.46
				40	6.57	32.38	25.43
				100	4.24	32.88	26.10
				150	5.38	33.51	26.48
				180	5.68	33.64	26.54
10257	Aug. 24	41 39 N. 69 49 W.	Off Chatham, Cape Cod	0	20.00	32.05	22.54
				25	6.80	32.09	25.18
10258	Aug. 25	41 03 N. 70 51 W.	On profile running southward from Marthas Vineyard	0	19.72	32.16	22.76
				15	14.29	32.43	24.16
				30	12.09	32.52	24.66
10259	...do...	40 34 N. 70 46 W.	...do	0	21.95	33.69	23.25
				25	14.83	33.53	24.12
				55	9.67	33.60	25.98
10260	Aug. 26	40 03 N. 70 41 W.	...do	0	22.89	33.78	23.08
				40	13.67	34.09	25.53
				100	11.63	35.23	26.88
				140	11.45	35.41	27.02
10261	...do...	39 54 N. 70 43 W.	...do.	0	23.50	34.11	23.14
				100	13.06	35.46	26.75
				200	11.99	----	----
				300	9.91	35.16	27.10
				450	7.26	35.16	27.53
10262	...do...	40 02 N. 70 28 W.	...do.	0	21.89	33.64	23.24
				46	13.07	33.89	25.53
				100	11.34	35.14	26.84
				180	10.35	35.26	27.11
10263	Aug. 27	41 12 N. 70 57 W.	...do.	0	17.89	32.12	23.11
				17	13.30	32.45	24.38
10264	Aug. 28	42 09 N. 70 00 W.	Off northern Cape Cod	0	16.67	----	----
				30	7.34	32.05	25.07
				80	5.65	32.48	25.63

TABLE. 9.—*Grampus stations, 1915*

10266	May 4	42° 30′ N. 70 20 W.	Offing of Gloucester	0	6.11	32.32	25.44
				50	3.55	32.68	26.01
				130	3.55	32.81	26.11
10267	May 5	42 38 N. 69 36 W.	Basin, offing of Cape Ann	0	6.10	33.03	26.00
				50	5.00	33.15	26.23
				130	4.69	33.17	26.27
				260	6.59	34.02	26.72

TABLE 9.—*Grampus stations, 1915*—Continued

Station	Date	Position	General locality	Depth	Temperature	Salinity	Density
		° ′					
10268	May 5	42 51 N. 68 43 W.	Center of gulf near Cashes Ledge	0 50 100 190	6.10 4.78 4.47 5.60	32.79 32.81 33.04 33.53	25.82 25.98 26.20 26.46
10269	May 6	43 04 N. 67 56 W.	Central part of basin	0 50 100 185	4.40 4.28 4.44 5.82	32.50 32.68 32.95 33.22	25.78 25.93 26.13 26.19
10270	...do....	43 14 N. 67 07 W.	East side of basin	0 50 100 190	3.60 3.04 3.90 5.95	31.78 32.03 32.86 33.58	25.29 25.53 26.12 26.46
10271	May 7	43 26 N. 66 28 W.	German Bank	0 35 70	3.00 3.24 3.27	31.89 31.94 31.94	25.42 25.44 25.43
10272	May 10	43 52 N. 66 41 W.	Near Lurcher Shoal	0 50 90	3.90 3.42 3.60	32.05 32.09 32.30	25.47 25.55 25.70
10273	...do....	44 05 N. 67 32 W.	Northeast part of basin, offing of Frenchmans Bay	0 50 100 150 225	4.70 4.81 5.10 4.98 6.28	32.23 32.57 33.03 33.28 33.66	25.54 25.80 26.12 26.34 26.48
10274	...do....	44 13 N. 67 51 W.	10 miles off Petit Manan Island	0 40 80	4.20 ------ 3.97	------ 32.20 32.23	------ [1]25.70 25.62
10275	May 11	44 09 N. 68 09 W.	5 miles east of Great Duck Island	0	4.40	31.51	25.00
10276	May 12	43 44 N. 68 50 W.	Offing of Penobscot Bay, close to Matinicus Rock	0 40 80	5.00 4.22 4.22	31.80 32.34 32.43	25.17 25.67 25.75
10277	May 13	43 32 N. 69 46 W.	Offing of Casco Bay	0 50 95	7.80 4.18 4.15	29.58 32.38 32.45	23.08 25.70 25.76
10278	May 14	43 00 N. 70 12 W.	Trough between Isles of Shoals and Jeffreys Ledge	0 50 100 175	7.80 4.04 3.45 3.70	32.03 32.63 32.70 32.94	25.00 25.92 26.03 26.19
10279	May 26	42 17 N. 70 07 W.	Mouth of Massachusetts Bay, off northern Cape Cod	0 40 70	10.00 5.20 3.82	31.89 32.68 32.68	24.55 25.84 25.98
10280	May 31	43 45 N. 69 32 W.	6 miles off Pemaquid Point	0 25	6.90 5.56	31.56 31.83	24.75 25.13
10281	June 4	44 48 N. 66 55 W.	Grand Manan Channel	0 40 80	4.40 4.63 4.58	31.82 31.82 31.83	25.24 25.21 25.24
10282	June 10	44 25 N. 66 32 W.	Bay of Fundy Deep between Grand Manan and Brier Island.	0 50 100 180	6.40 5.71 5.20 5.25	31.89 32.41 32.83 33.06	25.07 25.57 25.96 26.13
10283	...do....	44 15 N. 67 23 W.	Northeast part of basin in offing of Machias, Me.	0 50 100 180	5.40 5.27 5.00 3.54	31.98 ------ 32.70 33.66	25.26 ------ 25.87 26.78
10284	June 11	44 09 N. 67 54 W.	12 miles off Petit Manan Island	0 40 80	5.40 5.11 5.14	32.07 32.21 32.45	25.34 25.48 25.67
10285	June 14	44 09 N. 68 09 W.	5 miles east of Great Duck Island, off Mount Desert Island.	0	8.00	31.76	24.76
10286	...do....	43 59 N. 68 15 W.	Off Mount Desert Island	0 40 80	7.50 5.44 5.18	32.16 32.30 32.41	25.14 25.51 25.62

[1] Approximate.

TABLE 9.—*"Grampus" stations, 1915*—Continued

Station	Date	Position	General locality	Depth	Temperature	Salinity	Density
		° ′					
10287	June 14	43 44 N. 68 50 W.	Offing of Penobscot Bay close to Matinicus Rock	0	7.80	31.94	24.92
				35	5.83	32.16	25.31
				70	4.66	32.36	25.64
10288	June 19	43 28 N. 67 30 W.	Eastern side of basin	0	9.70	32.41	25.00
				50	5.60	32.50	25.65
				100	4.86	33.06	26.17
				150	5.60	33.46	26.40
				220	6.21	33.95	26.71
10289	do	43 27 N. 66 51 W.	do	0	7.80	32.25	25.16
				50	5.90	32.66	25.74
				100	5.70	33.24	26.22
				150	5.87	33.48	26.39
10290	do	43 24 N. 66 22 W.	German Bank	0	6.10	32.07	25.25
				25	5.90	32.09	25.29
				60	5.85	32.12	25.33
10291	June 23	43 29 N. 65 08 W.	Profile off Shelburne, Nova Scotia	0	8.90	30.93	23.96
				30	3.47	31.36	24.95
				75	0.96	31.92	25.58
10292	do	43 19 N. 64 59 W.	do	0	8.60	31.33	24.32
				50	0.70	31.83	25.53
				75	0.70	32.12	----------
				100	2.02	32.68	26.13
				150	4.32	----------	----------
10293	do	42 59 N. 64 43 W.	do	0	10.00	31.36	24.13
				40	1.54	31.91	25.53
				85	1.60	32.50	26.03
10294	do	42 36 N. 64 27 W.	do	0	9.70	31.06	23.95
				40	2.85	31.83	25.38
				80	2.12	32.79	26.22
				120	7.50	34.34	26.85
				170	8.28	34.67	26.99
10295	June 24	42 22 N. 64 16 W.	do	0	11.10	32.39	24.75
				80	3.63	34.27	27.22
				200	8.15	34.97	27.25
				300	7.30	34.94	27.35
				500	4.91	34.94	27.66
10296	do	42 28 N. 65 37 W.	Browns Bank	0	10.00	31.44	24.20
				40	2.80	32.29	25.76
				80	7.36	33.49	26.20
10297	June 25	42 17 N. 66 03 W.	Eastern channel between Browns and Georges Banks	0	10.00	32.56	25.06
				40	8.20	33.31	25.94
				100	8.14	34.18	26.62
				150	7.72	34.67	27.08
				225	7.20	34.92	27.35
10298	do	42 26 N. 67 45 W.	Southeast part of basin, north of Georges Bank	0	12.50	32.56	24.62
				50	5.18	32.59	25.76
				100	5.02	33.04	26.14
				150	5.68	33.48	6.41
				225	6.91	34.60	27.14
10299	June 26	42 32 N. 69 14 W.	Western side of basin in offing of Cape Ann	0	13.60	32.50	24.36
				50	6.22	33.04	26.00
				100	4.60	33.08	26.22
				210	5.67	33.82	26.68
10300	July 7	----------	Close to Race Point, Cape Cod	0	16.60	31.40	22.87
				50	6.70	32.20	25.27
10301	July 15	44 31 N. 67 24 W.	4 miles south 24° west of Libby Island at mouth of Machias Bay.	0	8.90	31.58	24.48
				60	7.16	32.03	25.09
10302	July 19	44 08 N. 68 15 W.	1 mile south of Great Duck Island, off Mount Desert Island.	0	11.60	31.83	24.24
				20	7.97	31.98	24.93
				45	7.24	32.16	25.18
10303	Aug. 4	43 46 N. 69 23 W.	3 miles west of Monhegan Island	0	11.60	31.87	24.27
				35	8.01	32.14	25.02
				75	5.96	32.41	55.54

TABLE 9.—"*Grampus*" *stations, 1915*—Continued

Station	Date	Position	General locality	Depth	Temperature	Salinity	Density
10304	Aug. 6–7	43° 32′ N. 67° 35′ W.	Eastern side of basin	0 50 100 150 200	11.40 8.26 6.22 4.78 6.89	32.63 32.67 33.12 33.73 34.16	24.89 25.42 26.06 26.71 27.15
10305	Aug. 18	44 08 N. 68 15 W.	1 mile south of Great Duck Island, off Mount Desert Island.	0 25 50	10.80 9.37 8.79	31.94 32.05 32.34	24.45 24.77 25.09
10306	Aug. 31	42 31 N. 70 19 W.	Mount of Massachusetts Bay, off Gloucester	0 50 100 140	16.10 7.24 5.97 5.78	31.24 32.39 32.50 32.57	22.89 25.35 25.60 25.68
10307	...do...	42 40 N. 69 34 W.	Basin, offing of Cape Ann	0 50 100 150 200 235	17.60 7.77 5.01 5.10 5.70 6.36	32.47 32.81 33.12 33.28 33.75 34.23	23.39 25.61 26.20 26.32 26.62 26.92
10308	Sept. 1	42 52 N. 68 40 W.	Near Cashes Ledge	0 40 90 165	15.80 9.02 6.36 5.63	32.52 32.59 33.03 33.69	23.88 25.25 25.97 26.58
10309	...do...	43 08 N. 67 52 W.	Central part of basin	0 50 100 150 210	15.50 9.44 5.72 5.77 5.98	32.47 32.66 33.10 33.60 33.60	23.99 25.23 26.11 26.50 26.47
10310	Sept. 2	43 15 N. 67 03 W.	Eastern side of basin	0 50 100 190	13.30 7.05 5.56 7.10	32.41 32.88 33.26 34.35	24.42 25.76 26.25 26.90
10311	...do...	43 22 N. 66 17 W.	German Bank	0 30 65	9.40 10.28 10.10	32.23 32.47 32.56	24.95 24.95 25.05
10312	...do...	43 14 N. 65 37 W.	9 miles off Cape Sable	0 25 50	13.30 9.40 7.38	31.49 31.73 32.00	23.64 24.51 25.02
10313	Sept. 6	43 28 N. 65 06 W.	11 miles off Cape Roseway, Nova Scotia	0 20 50 70	15.00 3.38 3.33 2.22	30.70 30.73 32.16 32.43	22.68 24.47 25.62 25.92
10314	...do...	43 20 N. 64 59 W.	21 miles off Cape Roseway, Nova Scotia	0 25 50 75 100 150	15.00 7.89 3.30 4.95 5.00 5.05	31.22 31.82 32.34 33.01 33.12 33.40	23.08 24.82 25.75 26.12 26.26 26.42
10315	Sept. 7	43 49 N. 66 44 W.	Near Lurcher Shoal	0 50 90	12.20 11.20 10.00	32.88 33.19 33.42	24.93 25.35 25.74
10316	Sept. 11	44 32 N. 67 22 W.	2 miles south of Libby Island at the mouth of Machias Bay.	0 60	10.28 9.95	32.30 32.43	24.82 24.97
10317	Sept. 15	44 05 N. 68 26 W.	3 miles south of Swans Island, Maine	0 28	11.60 10.95	32.50 32.52	24.74 24.88
10318	Sept. 16	43 43 N. 69 17 W.	4 miles southeast of Monhegan Island	0 35 70	13.60 [1]10.10 8.61	32.30 32.27 32.56	24.20 24.83 25.28
10319	Sept. 20	43 28 N. 70 16 W.	3 miles off Wood Island, Maine	0 25 50	15.50 10.50 8.50	---------- 31.83 32.12	---------- 24.41 24.96
10320	Sept. 29	43 25 N. 70 33 W.	Massachusetts Bay, 11 miles off Gloucester Harbor mouth.	0 35 70	10.50 [1]10.70 7.00	31.91 31.98 32.30	24.48 24.50 25.31

[1] Approximate only.

TABLE 9.—"*Grampus*" *stations, 1915*—Continued

Station	Date	Position	General locality	Depth	Temperature	Salinity	Density
10321	Sept. 29	42° 10′ N. 70 22 W.	Mouth of Massachusetts Bay, 8 miles off Race Point, Cape Cod.	0 20 40	11.40 ---- 11.22	31.73 31.83 ----	24.19 ±24.19 ----
10322	Oct. 1	42 04 N. 70 16 W.	Close to Race Point, Cape Cod	0 25	13.40 12.95	31.38 31.60	23.54 23.80
10323	...do....	42 17 N. 70 07 W.	Mouth of Massachusetts Bay, off Cape Cod	0 40 80	11.40 [1]11.00 6.00	32.07 32.25 33.06	24.45 24.66 26.03
10324	...do....	42 31 N. 70 19 W.	Mouth of Massachusetts Bay, off Gloucester	0 40 80 120 150	10.30 ---- 7.11 [1]7.20 6.78	32.21 32.25 32.50 32.57 32.66	24.75 ---- 25.45 25.50 25.62
10325	Oct. 4	43 00 N. 70 12 W.	Trough between Isles of Shoals and Jeffreys Ledge	0 50 100 175	11.60 7.33 6.40 5.28	32.21 32.39 32.81 33.22	24.53 25.35 25.79 26.26
10326	...do....	43 24 N. 69 53 W.	17 miles off Cape Elizabeth	0 50 100 145	11.90 7.61 ---- 5.39	32.41 32.90 32.90 33.48	24.63 25.70 ---- 26.45
10327	Oct. 9	44 32 N. 67 20 W.	2 miles south of Libbey Island, at the mouth of Machias Bay.	0 30 60	9.40 ---- 9.83	32.75 32.74 32.77	25.32 ---- 25.26
10328	...do....	44 06 N. 68 14 W.	3 miles south of Great Duck Island, off Mount Desert Island.	0 30 60	9.40 ---- 10.10	32.66 32.70 32.79	25.24 ---- 25.24
10329	...do....	43 44 N. 68 51 W.	Offing of Penobscot Bay, close to Matinicus Rock	0 30 60	10.00 10.30 8.95	32.47 32.56 32.84	25.00 25.02 25.46
10330	Oct. 18	42 34 N. 70 37 W.	2 miles eastward of Eastern Point, Gloucester	0	11.40	31.80	24.25
10331	Oct. 22	41 19 N. 70 55 W.	On profile off west end of Marthas Vineyard	0 30	[1]14.40 14.50	32.10 32.14	23.88 23.89
10332	...do....	40 51 N. 70 55 W.	On profile off west end of Marthas Vineyard	0 25 50	13.90 ---- 13.10	32.32 32.45 32.92	24.16 ---- 24.78
10333	Oct. 22	40 26 N. 70 56 W.	On profile off west end of Marthas Vineyard	0 25 50 80	13.30 13.20 ---- 11.89	32.65 32.74 32.97 33.68	24.53 24.62 ---- 25.61
10334	...do....	40 09 N. 71 00 W.	....do	0	15.50	33.86	25.00
10335	Oct. 25	41 26 N. 70 17 W.	Vineyard Sound	0	13.00	32.09	24.16
10336	Oct. 26	41 42 N. 69 53 W.	About 3 miles off Chatham, Cape Cod	0 25 50	10.50 ---- 9.39	32.00 32.03 32.41	24.55 ---- 24.76
10337	...do....	42 05 N. 70 18 W.	Mouth of Massachusetts Bay, 3 miles off Race Point, Cape Cod.	0 30 60	11.10 ---- 10.39	31.89 31.94 32.14	24.36 ---- 24.68
10338	Oct. 27	42 19 N. 70 30 W.	Mouth of Massachusetts Bay, midway between Cape Cod and Gloucester.	0 40	11.00 9.40	31.82 32.20	24.32 24.89
10339	...do....	42 31 N. 70 36 W.	Mouth of Massachusetts Bay, 5 miles off Gloucester Harbor mouth.	0 35 70	10.80 ---- 7.28	31.91 32.20 32.43	24.43 ---- 25.38

[1] Approximate only.

TABLE 10.—"*Grampus*" *stations, 1916*

Station	Date	Position	General locality	Depth	Temperature	Salinity	Density
		° ′					
10340	July 19	42 32 N. 78 38 W.	Mouth of Massachusetts Bay, 3 miles off mouth of Gloucester Harbor.	0	11.95	31.18	23.66
				25	6.49	31.87	25.04
				50	5.19	32.00	25.29
10341	...do....	42 18 N. 70 27 W.	Mouth of Massachusetts Bay, midway between Gloucester and Cape Cod.	0	16.39	30.48	22.22
				25	5.08	32.03	25.33
				50	3.90	32.20	25.59
				80	3.67	----------	----------
10342	...do....	42 07 N. 70 17 W.	Mouth of Massachusetts Bay, 4 miles off Race Point, Cape Cod.	0	17.22	30.61	22.13
				30	7.73	31.58	24.65
				60	6.14	31.87	25.08
10344	July 22	42 07 N. 69 59 W.	Offing of northern Cape Cod	0	15.83	30.75	22.55
				25	4.91	32.10	25.41
				50	4.07	32.20	25.58
				80	4.19	32.38	25.71
10345	...do....	41 52 N. 69 40 W.	Offing of Chatham, Cape Cod	0	10.00	31.53	24.27
				50	4.17	32.25	25.61
				100	3.85	32.66	25.96
				150	4.06	32.86	26.10
10346	...do....	41 27 N. 69 22 W.	Offing of southern angle of Cape Cod	0	7.22	32.03	25.07
				30	6.41	32.07	25.21
				60	4.47	32.38	25.68
10347	July 23	41 06 N. 68 51 W.	Northwest side of Georges Bank	0	11.39	32.54	24.81
				30	10.91	----------	----------
				60	9.61	32.14	24.81
10348	...do....	40 49 N. 68 21 W.	West side Georges Bank	0	11.67	32.54	24.75
				25	11.34	----------	----------
				50	11.26	32.57	24.86
10349	July 24	40 15 N. 68 05 W.	Southwest slope of Georges Bank	0	17.50	32.47	23.49
				30	10.36	[1] 33.86	----------
				80	7.16	[1] 32.47	----------
				130	6.75	34.42	27.01
				180	6.72	34.83	27.34
10351	...do....	40 06 N. 68 57 W.	...do	0	15.56	32.47	23.93
				30	10.66	----------	----------
				80	4.82	33.42	----------
				130	5.88	34.20	26.95
				180	7.13	34.72	27.20
10352	...do....	40 00 N. 68 44 W.	Continental slope southwest of Georges Bank	0	16.95	32.47	23.61
				50	4.85	33.08	26.19
				100	7.65	34.36	26.86
				200	7.65	34.92	27.23
				300	5.75	34.87	27.51
				400	5.15	34.87	27.57
				500	4.10	34.96	27.76
10353	July 25	40 14 N. 69 08 W.	Profile running southeasterly from Marthas Vineyard	0	15.00	----------	----------
10354	...do....	40 26 N. 69 24 W.	...do	0	13.61	32.27	24.18
				30	8.71	32.63	25.33
				70	6.07	32.86	25.88
10355	...do....	40 43 N. 69 53 W.	...do	0	11.95	31.73	24.08
				30	10.97	32.14	24.57
10356	July 26	40 57 N. 70 18 W.	...do	0	16.11	31.78	23.29
				30	12.14	32.14	24.36
10357	...do....	41 11 N. 70 44 W.	...do	0	17.78	30.90	22.19
				25	14.28	31.58	23.52
10398	Aug. 29	42 10 N. 70 09 W.	Off northern Cape Cod	0	16.95	31.27	22.70
				20	7.89	31.89	24.97
				43	4.91	32.05	25.57
10399	Oct. 31	42 30 N. 70 21 W.	Mouth of Massachusetts Bay, off Gloucester	0	10.00	31.71	24.41
				30	9.18	31.91	24.69
				60	6.43	32.41	25.47
				90	5.43	32.56	25.71
				120	5.23	32.59	25.76

[1] These two water samples probably were transposed,

TABLE 10.—"*Grampus*" *stations, 1916*—Continued

Station	Date	Position	General locality	Depth	Temperature	Salinity	Density
10400	Nov. 1	42° 58′ N., 70° 14′ W.	Trough between Isles of Shoals and Jeffreys Ledge	0	9.72	32.03	24.71
				30	8.21	32.09	24.98
				60	7.07	32.45	25.42
				90	4.84	32.57	25.79
				130	4.41	32.81	26.03
10401	...do...	42° 37′ N., 69° 46′ W.	Basin in offing of Cape Ann	0	10.56	31.98	24.54
				50	8.90	32.30	25.04
				100	4.24	32.65	25.91
				150	4.53	32.99	26.16
				200	4.99	33.53	26.53
10402	Nov. 2	43° 37′ N., 69° 15′ W.	9 miles off Monhegan Island	0	8.33	32.36	25.18
				25	8.89	32.34	25.07
				55	8.19	32.56	25.36
				85	6.59	32.78	25.74
				135	4.97	32.90	26.03
10403	Nov. 8	42° 16′ N., 70° 12′ W.	Mouth of Massachusetts Bay, off Cape Cod	0	9.17	31.87	24.66
				30	8.39	32.07	24.94
10404	...do...	41° 53′ N., 69° 37′ W.	Offing of southern Cape Cod	0	10.28	32.01	24.60
				50	8.04	32.18	25.07
				100	4,85	32.88	26.06
				175	4.78	33.15	26.26
10405	Nov. 10	41° 17′ N., 71° 03′ W.	On profile running southwesterly from offing of Buzzards Bay.	0	11.95	32.05	24.31
				30	12.52	32.06	24.23
10406	Nov. 11	40° 37′ N., 71° 19′ W.	...do...	0	11.67	32.23	24.52
				30	11.85	32.36	24.59
				60	9.98	32.54	25.07
10407	...do...	40° 03′ N., 71° 43′ W.	...do...	0	11.28	32.54	24.83
				30	11.85	32.56	24.74
				60	13.08	33.15	24.96
				90	7.72	32.88	----------
10408	...do...	39° 52′ N., 71° 47′ W.	...do...	0	11.39	32.59	24.86
				25	12.06	32.63	24.76
				50	14.0	33.71	25.21
				100	9.26	34.01	26.04
				180	10.26	35.00	26.93

TABLE 11.—"*Halcyon*" *stations, 1920*

Station	Date	Position	General locality	Depth	Temperature	Salinity	Density
10488	Dec. 29	42° 27′ N., 70° 43′ W.	Massachusetts Bay, off Boston Harbor	0	3.89	31.82	25.29
				20	4.48	31.92	25.32
				40	5.32	----------	----------
				60	5.86	32.30	25.54
10489	...do...	42° 30′ N., 70° 17′ W.	Mouth of Massachusetts Bay, off Gloucester	0	5.56	----------	----------
				40	6.94	----------	----------
				100	6.97	33.82	26.52
				150	7.00	33.84	26.53
10490	...do...	42° 38′ N., 69° 33′ W.	Basin in offing of Cape Ann	0	6.11	32.76	25.76
				40	----------	----------	----------
				100	----------	33.53	26.16
				175	5.93	33.73	26.58
				250	5.14	33.85	26.76
10491	Dec. 30	42° 00′ N., 69° 38′ W.	Off northern Cape Cod	0	6.67	32.97	25.88
				40	6.82	[1]33.21	----------
				100	6.92	[1]33.01	----------
10492	...do...	42° 51′ N., 70° 46′ W.	Off Merrimac River	0	4.00	30.02	23.86
				15	4.72	31.87	25.25
				30	6.80	32.60	25.58

[1] Probably transposed.

TABLE 11.—"*Halcyon*" *stations, 1920*—Continued

Station	Date	Position	General locality	Depth	Temperature	Salinity	Density
10493	Dec. 30	42° 59′ N. 70° 10′ W.	Trough between Isles of Shoals and Jeffreys Ledge	0	5.83	32.60	25.71
				40	6.38	----------	----------
				100	6.95	32.89	25.78
				150	6.95	32.87	25.78
10494	...do...	43° 24′ N. 70° 09′ W.	Off Wood Island, Me.	0	5.56	31.41	24.79
				40	6.23	32.65	25.69
				75	7.31	32.79	25.66
10495	Dec. 31	43° 39′ N. 69° 36′ W.	Off Seguin Island	0	5.83	32.60	25.71
				40	6.11	32.74	25.77
				75	6.11	32.77	25.80

TABLE 12—"*Halcyon*" *stations, 1921*

Station	Date	Position	General locality	Depth	Temperature	Salinity	Density
10496	Jan. 1	43° 37′ N. 68° 44′ W.	Offing of Penobscot Bay	0	5.56	32.31	25.50
				40	6.05	32.77	25.81
				100	6.79	32.89	25.80
				150	7.55	33.71	26.35
10497	...do...	44° 05′ N. 68° 11′ W.	5 miles off Great Duck Island, off Mount Desert Island, Me.	0	4.72	32.30	25.59
				40	5.53	32.54	25.68
				90	5.72	32.61	25.72
10498	Jan. 4	44° 32′ N. 67° 13′ W.	Off Machias, Me.	0	5.56	----------	----------
				40	5.61	----------	----------
				70	5.61	----------	----------
10499	...do...	44° 21′ N. 66° 37′ W.	Fundy Deep, between Grand Manan and Brier Island	0	5.56	32.11	----------
				40	5.98	32.45	----------
				100	6.03	32.69	----------
				150	6.65	32.75	----------
				200	6.96	32.97	----------
10500	...do...	43° 59′ N. 66° 52′ W.	Off Lurcher Shoal	0	5.83	32.51	25.63
				40	6.17	32.51	25.60
				110	6.72	33.08	25.96
10501	...do...	43° 48′ N. 66° 18′ W.	Off Yarmouth sea buoy, Nova Scotia	0	3.80	31.21	24.81
				20	3.89	31.26	24.85
				40	3.86	31.29	24.87
10502	Jan. 5	44° 07′ N. 67° 22′ W.	Eastern part of basin	0	5.56	32.21	25.42
				40	6.74	32.31	25.36
				100	6.59	32.70	25.68
				150	7.22	33.37	26.12
				200	6.92	33.93	26.61
10503	Jan. 9	42° 44′ N. 69° 55′ W.	Basin in offing of Cape Ann	0	5.56	32.51	25.68
				40	5.79	32.70	25.79
				100	6.53	32.93	25.86
				150	7.57	33.75	26.36
				200	5.29	33.95	26.83
10504	Feb. 9	42° 33′ N. 70° 39′ W.	1½ miles off Eastern Point, Gloucester	0	3.33	----------	----------
				20	3.52	----------	----------
				40	3.63	----------	----------
10505	Mar. 4	42° 27′ N. 70° 44′ W.	North side, Massachusetts Bay, off Bakers Island	0	2.22	32.18	25.72
				20	2.37	----------	----------
				40	2.55	32.39	25.86
10506	...do...	42° 52′ N. 70° 47′ W.	Off Merrimac River	0	1.67	31.54	25.24
				25	1.81	32.08	25.66
10507	...do...	43° 22′ N. 70° 08′ W.	Off Cape Porpoise, Me.	0	2.20	32.35	25.86
				40	3.01	32.47	25.88
				100	3.12	32.47	25.87
10508	...do...	43° 39′ N. 69° 38′ W.	Off Seguin Island	0	1.67	32.32	25.86
				30	2.42	32.30	25.80
				60	2.52	32.41	25.88

TABLE 12.—"*Halcyon*" *stations, 1921*—Continued

Station	Date	Position	General locality	Depth	Temperature	Salinity	Density
10509	Mar. 5	43° 00′ N. 70° 10′ W.	Trough between Isles of Shoals and Jeffreys Ledge	0	3.90	32.85	25.79
				40	4.10	32.79	25.73
				100	4.32	32.86	26.07
				175	4.38	32.99	26.17
10510	do	42 42 N. 60 45 W.	Basin in offing of Cape Ann	0	3.60	32.49	25.85
				40	3.60	32.47	25.84
				100	4.10	32.65	25.93
				150	5.50	33.12	26.15
				175	6.50	----------	----------
				225	5.50	----------	----------
				250	4.63	33.99	26.93
10511	do	42 31 N. 70 18 W.	Mouth of Massachusetts Bay, off Gloucester	0	3.61	32.64	25.97
				40	3.84	32.70	26.00
				100	3.85	32.76	26.04
				150	3.86	32.70	26.00

TABLE 13.—"*Halcyon*" *stations in Massachusetts Bay, August, 1922*

Station	Date	Position	General locality	Depth	Temperature	Salinity	Density
10631	Aug. 22	42° 06′ 00″ N. 70° 17′ 00″ W.	2½ miles off Race Point, Cape Cod	0	17.80	31.20	22.52
				18	13.00	31.61	23.79
				64	6.20	32.18	25.32
10632	do	42 22 00 N. 70 26 00 W.	Stellwagen Bank, midway between Cape Cod and Gloucester.	0	18.00	31.21	22.37
				18	9.20	31.86	24.65
				27	7.70	31.98	24.96
				73	4.50	32.37	25.66
10633	do	42 32 00 N. 70 35 00 W.	Mouth of Massachusetts Bay, 4 miles off Eastern Point, Gloucester.	0	18.70	30.99	22.05
				9	18.60	31.00	22.09
				27	8.40	31.96	24.85
				55	5.40	32.23	25.46
10636	Aug. 24	42 30 00 N. 70 46 00 W.	Near Halfway Rock, off Marblehead	0	15.80	31.09	22.81
				11	11.30	31.53	24.05
				27	7.00	31.99	25.07
10637	do	42 26 30 N. 70 53 30 W.	Near Egg Rock, off Nahant	0	15.30	----------	----------
				18	9.80	----------	----------
10638	do	42 23 00 N. 70 48 00 W.	Off Boston Harbor	0	17.50	30.95	22.33
				27	8.80	31.87	24.73
10639	do	42 16 30 N. 70 47 00 W.	Off Minots Light	0	16.90	31.02	22.50
				15	13.90	31.20	23.30
10640	do	42 16 30 N. 70 35 00 W.	Off Scituate	0	18.40	31.04	22.15
				15	16.10	31.35	22.88
				51	5.60	32.25	25.45
10641	do	42 07 00 N. 70 38 00 W.	Off Brant Rock	0	17.80	31.04	22.32
				15	10.30	----------	----------
10642	do	41 56 30 N. 70 32 00 W.	Off Manomet	0	16.10	31.10	22.76
				18	13.20	----------	----------
10643	do	41 46 30 N. 70 26 30 W.	Cape Cod Bay, off Sandwich	0	17.80	30.97	22.26
				15	12.10	31.38	23.80
10644	do	41 46 00 N. 70 16 30 W.	Cape Cod Bay, off Barnstable Harbor	0	18.30	30.97	22.11
				13	17.90	----------	----------
10645	do	41 58 00 N. 70 21 00 W.	Midway between Provincetown and Plymouth	0	18.10	31.06	22.26
				13	17.90	----------	----------
				42	7.20	31.95	25.02

TABLE 14.—"*Halcyon*" *stations, 1923–1924*

Station	Date	Position	General locality	Depth	Temperature
		° ′ ″			
10646	Apr. 18, 1923	42 17 00 N. 70 29 00 W.	Mouth of Massachusetts Bay	0 37 80	2.80 1.60 .32
10647	do	41 55 00 N. 69 50 00 W.	Off Nauset, Cape Cod	0 27 64	2.80 2.00 2.20
10647	Apr. 27, 1923		Rose and Crown Shoal	0	3.30
	Aug. 5, 1923	44 11 00 N. 68 09 00 W.	Off Bakers Island, near Mount Desert	0 27 55	11.70 7.44 6.88
	Aug. 6, 1923	43 52 00 N. 67 54 00 W.	Off Mount Desert Rock	0 37 91 128 165	12.80 7.58 4.40 4.78 5.36
	Aug. 7, 1923	43 32 00 N. 70 11 00 W.	Whistle Buoy, off Cape Elizabeth	0 27 46	16.10 9.86 6.85
	do	43 18 00 N. 69 44 00 W.	25 miles off Cape Elizabeth	0 37 73 118	18.10 4.28 3.55 3.45
	Aug. 9, 1923	42 30 00 N. 70 17 30 W.	Off Gloucester	0 46 82 118 155	17.20 4.99 3.09 2.90 2.97
10652	Mar. 19, 1924	42 27 00 N. 70 36 00 W.	8 miles off Eastern Point, Gloucester	0 18 37 73	2.20 1.80 1.79 1.77
10653	June 6, 1924	42 27 00 N. 70 36 00 W.	do	0 18 37 55 73	10.60 6.25 3.58 3.13 3.13
10654	July 12, 1924	42 26 30 N. 70 37 00 W	do	0 18 37 73	16.70 6.80 4.60 3.84
10655	July 15, 1924	41 22 00 N. 69 32 00 W.	Nantucket Shoals	0 9 18 27	10.00 10.50 10.50 10.40
10656	Aug. 5, 1924	44 04 00 N. 68 07 15 W.	7 miles off Great Duck Island, Mount Desert	0 18 37 55 91	10.80 7.43 6.91 6.17 5.57
10657	Aug. 23, 1924	42 26 30 N. 70 36 15 W.	8 miles off Eastern Point, Gloucester	0 18 46 73	15.60 12.50 5.48 3.98
10664	Sept. 6, 1924	42 26 30 N. 70 37 00 W.	do	0 18 37 73	15.60 12.32 6.45 4.34
10665	Sept. 18, 1924	42 53 00 N. 70 19 30 W.	Jeffreys Ledge	0 55	14.40 7.05
10666	Sept. 24, 1924		1½ miles east-southeast (mag.) from White Island off Boothbay Harbor, Me.	0 24	11.70 10.65
10667	Sept. 29, 1924	44 04 00 N. 68 07 00 W.	7 miles off Great Duck Island, off Mount Desert	0 18 37 55 91	10.80 9.80 8.70 8.98 [illegible]

TABLE 14.—*"Halcyon" stations, 1923–1924*—Continued

Station	Date	Position (° ″)	General locality	Depth	Temperature
10668	Oct. 3, 1924	------	½ mile northeast (mag.) from Little Duck Island, off Mount Desert, Me.	0	11.70
				27	10.08
10669	Oct. 15, 1924	42 26 30 N. 70 37 00 W.	8 miles south (mag.) from Eastern Point, Gloucester	0	11.70
				18	11.40
				37	10.08
				73	6.76

TABLE 15.—*Ice Patrol stations, 1919 (from Coast Guard Bulletin No. 11, 1924)*

Station	Date	Position (° ′)	General locality	Depth	Temperature	Salinity	Density
1	Mar. 28	42 06 N. 69 52 W.	Offing of northern Cape Cod	0	4.50	32.43	25.71
				27	3.65	32.29	25.68
				55	2.90	32.48	25.90
				77	3.75	32.61	25.93
				101	3.80	32.66	25.97
2	Mar. 29	42 23 N. 69 03 W.	do	0	4.70	32.72	25.92
				40	3.90	32.68	25.98
				80	3.05	32.66	26.03
				121	4.45	32.77	26.00
				161	5.25	33.46	26.45
3	do	42 51 N. 67 32 W.	East-central part of gulf	0	0.00	31.87	25.60
				55	3.70	32.62	25.95
				110	4.75	33.58	26.60
				165	4.75	33.84	26.80
				216	4.75	------	------
19	April 28	42 06 N. 69 52 W.	Offing of northern Cape Cod	0	4.70	31.29	24.79
				27	5.15	31.71	25.07
				64	3.75	31.76	25.26
				101	3.75	32.09	25.52
20	do	42 23 N. 69 03 W.	do	0	4.90	(1)	------
				37	4.85	------	------
				73	4.85	------	------
				110	4.80	------	------
				146	4.35	------	------
21	do	42 51 N. 67 32 W.	East-central part of gulf	0	4.60	31.98	25.85
				55	3.65	32.38	25.76
				110	4.45	32.92	26.11
				165	4.40	------	------
				220	------	------	------
22	do	43 17 N. 66 20 W.	German Bank	0	2.70	31.71	25.30
				18	2.90	31.71	25.29
				37	2.70	------	------
				55	2.75	31.71	25.30
35	May 29	42 06 N. 69 52 W.	Offing of northern Cape Cod	0	9.30	31.53	24.37
				35	6.05	31.80	25.05
				70	4.30	32.02	25.41
				104	4.00	32.48	25.80
				139	4.05	32.68	25.96
36	do	42 23 N. 69 03 W.	do	0	9.00	31.80	24.63
				55	4.60	33.16	26.28
				110	4.75	33.16	26.27
				165	5.40	33.48	26.44
				220	5.60	33.91	26.76
37	do	42 51 N. 67 32 W.	East-central part of basin	0	7.80	31.96	24.94
				60	4.30	32.49	25.78
				121	4.95	33.50	26.
				181	6.06	34.29	27.01
				242	6.15	------	------
38	May 30	43 17 N. 66 20 W.	German Bank	0	4.20	31.67	25.14
				27	4.20	31.71	25.17
				55	4.20	31.76	25.21
				82	------	31.80	------

[1] Salinities for this station are omitted because irregular. They are given in U. S. Coast Guard Bulletin 11, 1924, p. 104.

TABLE 16.—"*Albatross*" *stations, 1920*

Station	Date	Position	General locality	Depth	Temperature	Salinity	Density
20044	Feb. 22	40° 07′ N., 68° 03′ W.	Continental slope southwest of Georges Bank	0	4.44	----------	----------
				50	9.76	34.45	26.61
				100	12.39	35.18	26.67
				200	12.39	35.27	26.73
				300	10.91	35.32	27.06
				500	7.24	35.00	27.41
				1000	4.21	34.90	27.70
				1400	3.92	34.92	27.75
				1800	3.62	34.90	27.77
20045	...do....	40 18 N., 68 09 W.	Southwestern slope of Georges Bank	0	5.00	32.34	25.59
				20	4.59	32.92	26.09
				50	9.40	34.42	26.61
				100	12.35	35.34	26.79
				150	11.55	35.25	26.89
20046	...do....	40 38 N., 68 21 W.	Southwestern part of Georges Bank	0	5.00	32.34	25.59
				10	3.37	32.38	25.78
				40	4.50	32.77	25.98
				50	7.11	----------	----------
				70	8.03	----------	----------
20047	Feb. 23	41 08 N., 68 35 W.	Western part, Georges Bank	0	4.44	32.39	25.69
				20	----------	32.38	----------
				50	----------	32.47	----------
20048	...do....	41 41 N., 68 49 W.	Southwest part of basin, north of Georges Bank	0	3.33	32.47	25.86
				20	3.48	32.47	25.85
				50	3.49	32.47	25.88
				75	3.55	32.43	25.81
				100	3.54	32.49	25.86
				150	4.87	32.97	26.10
20049	...do....	42 30 N., 69 35 W.	Basin in offing of Cape Ann	0	3.33	32.52	25.93
				20	2.79	32.51	25.94
				50	2.79	32.52	25.95
				100	3.04	32.54	25.94
				150	5.66	33.40	26.37
				200	5.63	33.78	26.68
20050	Mar. 1	42 30 N., 70 18 W.	Mouth of Massachusetts Bay off Gloucester	0	2.50	32.35	25.83
				20	1.95	32.34	25.87
				40	1.89	32.36	25.89
				100	1.52	32.34	25.90
				150	1.68	32.39	25.94
20051	Mar. 1-2	42 31 N., 70 09 W.	Mouth of Massachusetts Bay	(1)	----------	----------	----------
20052	Mar. 2	42 43 N., 68 41 W.	Near Cashes Ledge	0	2.62	32.49	25.94
				20	2.24	32.52	26.00
				40	2.48	32.52	25.98
				100	2.47	32.52	25.98
				150	3.60	32.66	25.97
				200	5.24	33.44	26.43
20053	Mar. 3	42 45 N., 67 28 W.	Southeast part of basin	0	2.78	32.54	25.97
				20	2.20	32.59	26.06
				40	2.34	32.57	26.02
				100	2.28	32.61	26.05
				150	4.96	33.87	26.81
				225	5.39	34.36	27.15
20054	...do....	43 15 N., 67 45 W.	Basin in offing of Mount Desert Rock	0	2.50	32.41	25.88
				20	1.84	32.39	25.92
				40	1.84	32.39	25.92
				100	1.77	32.41	25.94
				175	5.40	33.75	26.67
				250	5.48	34.00	26.82
20055	...do....	43 42 N., 67 55 W.	19 miles off Mount Desert Rock	0	2.50	32.38	25.86
				20	1.85	32.39	25.92
				40	1.82	32.41	25.93
				100	4.39	33.16	26.30
				150	5.46	33.77	26.64
				220	5.59	33.91	26.74
20056	...do....	44 05 N., 68 08 W.	6 miles off Great Duck Island, off Mount Desert Island	0	1.15	32.21	25.82
				20	0.50	32.29	25.91
				40	0.49	32.23	25.87
				100	1.95	32.48	25.97

[1] Current station, see U. S. Bureau of Fisheries, 1921, p. 156.

TABLE 16.—"*Albatross*" *stations, 1920*—Continued

Station	Date	Position	General locality	Depth	Temperature	Salinity	Density
20057	Mar. 4	43° 21′ N. 68° 58′ W.	Offing of Penobscot Bay	0	2.22	32.39	25.89
				20	1.91	32.40	25.93
				40	1.91	32.41	25.93
				75	1.89	32.41	25.93
				125	2.00	32.43	25.94
20058	...do	43° 41′ N. 69° 38′ W.	Near Seguin Island	0	1.39	31.31	25.09
				15	0.68	32.00	25.67
				45	1.43	32.34	25.90
20059	...do	43° 25′ N. 70° 12′ W.	6 miles off Wood Island, Me	0	1.11	32.09	25.72
				20	0.47	32.10	25.77
				40	0.61	------	------
				90	2.33	32.32	25.83
20060	...do	43° 02′ N. 70° 27′ W.	10 miles off mouth of Portsmouth Harbor, N. H	0	1.39	32.28	25.36
				20	1.25	32.27	25.86
				40	1.28	32.30	25.88
				90	1.15	32.30	25.89
20061	Mar. 5	43° 00′ N. 70° 11′ W.	Trough between Isles of Shoals and Jeffreys Ledge	0	1.30	32.2	------
				20	.85	32.17	25.80
				40	1.33	32.34	25.91
				100	1.96	32.41	25.92
				165	4.29	------	------
				175	4.26	32.91	26.12
20062	...do	42° 26′ N. 70° 43′ W.	Massachusetts Bay, off Boston Harbor	0	.78	32.14	25.78
				20	.55	------	------
				50	.33	32.16	25.82
	Mar. 10	42° 20′ N. 70° 40′ W.	Central part, Massachusetts Bay	0	1.10	32.00	25.65
	...do	42° 17′ N. 70° 07′ W.		0	2.20	32.43	25.92
	...do	42° 12′ N. 69° 06′ W.		0	2.20	32.65	26.10
20063	Mar. 11	42° 06′ N. 68° 10′ W.	Southern side of basin	0	3.61	32.61	25.95
				15	3.49	32.59	25.95
				35	3.09	32.66	26.03
				95	3.05	32.63	26.02
				140	4.30	33.16	26.31
				190	4.63	34.61	27.44
20064	...do	42° 20′ N. 67° 13′ W.	Southeast part of basin north of Georges Bank	0	3.50	32.84	26.14
				20	2.80	32.83	26.20
				40	2.73	32.84	26.26
				100	3.18	32.95	26.26
				150	4.26	33.66	26.71
				200	4.32	34.69	27.52
				265	4.24	34.76	27.60
				330	4.02	34.78	27.63
20065	...do	41° 55′ N. 66° 53′ W.	Northeast part, Georges Bank	0	3.61	32.63	25.97
				20	2.97	32.66	26.04
				40	2.95	32.65	26.03
				80	2.73	32.69	26.20
20066		41° 34′ N. 66° 45′ W.	East part, Georges Bank	0	3.33	32.57	25.94
				20	2.78	32.61	26.03
				40	2.73	32.61	26.02
				70	2.53	32.59	26.02
20067	Mar. 12	41° 15′ N. 66° 31′ W.	Southeast part, Georges Bank	0	3.05	32.68	26.06
				20	3.07	32.68	26.06
				40	2.83	32.75	26.14
				90	2.80	32.79	26.17
20068	...do	41° 02′ N. 66° 20′ W.	Southeast slope of Georges Bank	0	3.33	32.65	26.00
				20	2.90	32.66	26.05
				40	2.92	32.66	26.05
				100	3.56	32.83	26.13
				150	4.40	33.86	26.87
				190	4.92	34.23	27.09

TABLE 16.—"*Albatross*" *stations, 1920*—Continued

Station	Date	Position	General locality	Depth	Temperature	Salinity	Density
20069	Mar. 12	40 47 N. 66 08 W.	Continental slope southeast of Georges Bank	0	3.33	----	----
				50	3.11	32.79	26.14
				100	7.09	33.86	26.52
				150	7.01	34.63	27.15
				200	5.92	34.67	27.32
				300	4.73	34.67	27.46
				400	4.32	34.71	27.54
				500	4.26	34.81	27.62
				1,000	3.77	34.92	27.71
20070	Mar. 13	42 03 N. 66 15 W.	Northeast edge Georges Bank	0	3.05	32.66	26.04
				20	2.78	32.67	26.06
				40	2.74	32.66	26.06
				90	2.59	32.70	26.10
20071	do	42 19 N. 66 02 W.	Eastern Channel between Georges and Browns Bank	0	3.33	32.81	26.13
				20	2.90	32.83	26.18
				40	3.15	32.86	26.19
				100	6.48	34.29	26.95
				150	6.85	34.42	27.00
				215	6.84	34.70	27.23
20072	do	42 36 N. 65 59 W.	Browns Bank	0	1.95	32.32	25.86
				20	1.88	32.34	25.87
				40	2.14	32.57	26.04
				90	3.40	33.02	26.29
20073	Mar. 17	43 30 N. 65 06 W.	On profile running southeasterly from the offing of Shelburne, Nova Scotia.	0	2.22	32.44	25.92
				20	2.10	32.43	25.93
				40	2.10	32.48	25.97
				70	2.52	32.71	26.12
20074	Mar. 19	43 18 N. 64 58 W.	do	0	1.39	32.09	25.70
				20	1.24	32.07	25.71
				40	1.10	32.07	25.71
				100	2.86	32.94	26.26
				150	4.68	33.69	26.70
20075	do	42 55 N. 64 36 W.	do	0	0.56	31.80	25.53
				20	0.27	31.83	25.56
				40	0.45	31.82	25.54
				90	3.76	33.21	26.40
20076	do	42 33 N. 64 30 W.	do	0	1.28	32.06	25.69
				20	0.99	32.08	25.70
				40	1.20	32.20	25.81
				100	7.39	----	----
				150	8.61	34.34	26.71
				200	6.20	34.70	26.91
				250	5.40	34.65	27.32
20077	Mar. 19–20	42 24 N. 64 19 W.	Continental slope in offing of Shelburne, Nova Scotia	0	1.67	32.16	25.75
				40	1.29	32.19	25.79
				100	5.82	33.78	26.52
				200	7.89	34.85	27.20
				300	6.32	34.85	27.38
				500	4.23	34.83	27.42
				1,000	3.90	34.88	27.72
20078	Mar. 20	42 58 N. 65 48 W.	Northern Channel between Browns Bank and Cape Sable.	0	1.95	32.45	25.95
				20	1.82	32.45	25.95
				40	2.12	32.43	25.93
				100	2.67	32.72	26.11
				135	4.59	33.58	26.62
20079	Mar. 22	44 21 N. 66 37 W.	Fundy Deep between Grand Manan and Brier Island	0	2.50	32.56	26.00
				20	2.14	32.54	26.01
				40	2.17	32.53	26.01
				100	2.55	32.70	26.10
				150	3.32	33.01	26.29
				200	4.29	33.31	26.44
20080	do	44 21 N. 67 37 W.	11 miles east of Petit Manan Island	0	1.39	32.05	25.67
				30	1.26	32.16	25.77
				60	1.43	32.25	25.83
20081	Mar. 22–23	44 08 N. 67 26 W.	Northeast part of basin, in offing of Petit Manan	0	1.95	32.32	25.85
				20	1.76	32.32	25.87
				40	1.63	32.36	25.90
				100	2.26	32.59	26.05
				150	5.07	33.67	26.63
				200	5.39	33.84	26.73

TABLE 16.—"*Albatross*" *stations, 1920*—Continued

Station	Date	Position	General locality	Depth	Temperature	Salinity	Density
20082	Mar. 23	43° 54′ N. 66° 53′ W.	Off Lurcher Shoal	0	2.67	32.59	26.02
				20	2.35	32.61	26.05
				50	2.52	32.72	26.13
				120	3.35	33.15	26.40
20083	...do....	43 41 N. 66 21 W.	Off Yarmouth, Nova Scotia	0	1.95	32.17	25.73
				20	1.54	32.18	25.77
				40	1.54	32.22	25.79
				65	2.04	32.54	26.02
20084	...do....	43 18 N. 66 09 W.	Off Cape Sable, Seal Island, Nova Scotia	0	2.11	32.16	25.71
				20	1.74	32.16	25.74
				50	1.81	32.23	25.80
20085	...do....	43 17 N. 66 33 W.	German Bank	0	2.50	----------	----------
				30	2.40	32.63	26.07
				70	2.43	32.63	26.06
20086	...do....	43 11 N. 67 12 W.	East side of basin	0	3.61	----------	----------
				20	3.40	33.10	26.35
				40	3.39	33.10	26.35
				100	4.29	33.63	26.69
				170	5.01	34.00	26.90
20087	Mar. 24	42 37 N. 69 27 W.	West side of basin, in offing of Cape Ann	0	3.05	32.49	25.90
				20	2.74	32.56	25.98
				40	2.74	32.54	25.96
				100	2.80	32.63	26.04
				150	5.37	33.53	26.49
				200	5.39	34.05	26.90
				250	5.06	34.22	27.05
20088	...do....	42 15 N. 69 54 W.	Off northern Cape Cod	0	2.50	32.36	25.85
				20	2.20	32.39	25.90
				40	2.20	32.44	25.93
				100	3.61	32.92	26.19
				180	4.97	33.58	26.58
20089	Apr. 6	42 26 N. 70 43 W.	Massachusetts Bay, off Boston Harbor	0	3.05	31.25	24.92
				10	2.39	31.26	24.97
				25	2.31	31.30	25.02
				60	1.49	32.31	25.08
20090	Apr. 9	42 30 N. 70 19 W.	Mouth of Massachusetts Bay, off Gloucester	0	3.33	32.36	25.76
				10	2.50	32.34	25.83
				30	2.42	32.34	25.83
				90	2.34	32.47	25.95
				120	2.25	32.48	25.97
20091	...do....	42 43 N. 70 22 W.	Jeffreys Ledge, off Cape Ann	0	3.33	31.97	25.46
				20	2.48	32.08	25.60
				60	2.50	32.45	25.91
20092	...do....	42 49 N. 70 37 W.	Off Merrimac River	0	3.05	31.01	24.72
				20	1.94	----------	----------
				40	2.45	----------	----------
				80	2.35	----------	----------
20093	...do....	42 57 N. 70 07 W.	Western slope of Jeffreys Ledge	0	3.05	31.92	25.45
				20	2.42	32.02	25.58
				40	2.26	32.35	25.85
				100	3.59	32.81	26.10
				160	4.29	33.10	26.25
20094	Apr. 10	43 08 N. 69 40 W.	Platts Bank	0	2.78	32.16	25.66
				20	2.34	32.17	25.76
				40	2.46	32.41	25.89
				90	2.82	32.56	25.97
20095	...do....	43 25 N. 70 12 W.	7 miles off Wood Island, Me.	0	3.05	30.07	23.97
				20	2.71	----------	----------
				40	2.25	32.50	25.97
				90	2.22	----------	----------
20096	...do....	43 40 N. 69 37 W.	Near Seguin Island	0	2.78	29.94	23.89
				20	2.02	31.60	25.28
				60	2.39	32.41	25.89

TABLE 16.—"*Albatross*" *stations, 1920*—Continued

Station	Date	Position	General locality	Depth	Temperature	Salinity	Density
20097	Apr. 10, 11	43° 19′ N., 68° 55′ W.	Offing of Penobscot Bay	0	3.33	32.43	25.83
				20	2.40	32.43	25.90
				40	2.13		
				100	3.46		
				125	4.51	33.26	26.37
20098	Apr. 11	43 43 N., 67 55 W.	Off Mount Desert Rock	0	3.05	32.39	25.83
				20	2.33	32.44	25.92
				40	2.53		
				100	3.53		
				150	4.91	33.89	26.84
				210	5.28	34.22	27.05
20099	Apr. 12	44 15 N., 67 53 W.	Off Petit Manan Island	0	3.61	31.46	25.03
				20	2.23	31.90	25.50
				40	2.34	32.38	25.86
				70	2.60	32.56	25.99
20100	do	44 09 N., 67 26 W.	Northeast part of basin, in offing of Petit Manan Island	0	3.89	32.49	25.82
				15	3.07	32.59	25.98
				35	3.29	32.87	26.18
				95	4.50	33.55	26.60
				145	5.06	33.98	26.89
				195	5.12	34.06	26.95
				225	5.14	34.09	26.96
20101	do	43 53 N., 66 51 W.	Off Lurcher Shoal	0	4.28	32.89	26.10
				20	3.39	32.94	26.22
				40	3.67	33.03	26.27
				100	4.58		
				140	4.71	33.78	26.77
20102	Apr. 13	43 42 N., 66 21 W.	Off Yarmouth, Nova Scotia	0	3.89	32.36	25.72
				20	3.26		
				40	3.00	32.56	25.96
				60	2.83	32.56	25.97
20103	Apr. 15	43 20 N., 66 36 W.	German Bank	0	3.89	32.74	26.02
				20	3.35	32.72	26.06
				40	3.44	32.79	26.11
				90	3.46	32.79	26.11
20104	do	43 13 N., 65 59 W.	South of Blonde Rock, off Cape Sable	0	3.05	32.32	25.77
				15	2.80	32.34	25.80
				45	2.83	32.38	25.82
20105	do	42 58 N., 65 58 W.	Northern Channel, between Cape Sable and Browns Bank.	0	3.61	32.43	25.80
				20	3.61	32.42	25.80
				35	3.11	32.77	26.12
				95	3.16	32.83	26.16
				125	3.15	32.84	26.17
20106	Apr. 16	42 39 N., 66 01 W.	Browns Bank	0	3.61	32.72	26.03
				20	3.40	32.74	26.06
				40	3.35	32.73	26.06
				80	3.32	32.75	26.09
20107	do	42 19 N., 66 02 W.	Eastern Channel, between Browns and Georges Banks	0	3.33	32.34	25.75
				20	3.10	32.34	25.77
				40	3.21	32.56	25.94
				100	5.86	33.86	26.68
				170	7.45	34.59	27.05
				240	6.07	34.69	27.32
20108	do	41 57 N., 66 05 W.	Eastern edge of Georges Bank	0	4.17	32.58	25.87
				20	3.62	32.59	25.94
				50	3.08	32.60	25.98
				130	3.75	33.05	26.29
20109	do	41 17 N., 66 09 W.	Southeast slope of Georges Bank	0	4.17	32.65	25.92
				20	3.63	32.66	25.98
				40	3.54	32.65	25.99
				100	4.22	33.46	26.56
				150	6.47	34.52	27.13
20110	do	41 38 N., 66 26 W.	Eastern part of Georges Bank	0	3.89	32.67	25.97
				20	3.54	32.70	26.02
				40	3.42	32.69	26.03
				80	3.59	32.70	26.02

TABLE 16.—"*Albatross*" *stations, 1920*—Continued

Station	Date	Position	General locality	Depth	Temperature	Salinity	Density
20111	Apr. 17	° 41 69 N. 66 43 W.	Eastern part of Georges Bank	0	4.17	32.60	25.88
				20	3.62	32.61	25.94
				40	3.76	32.61	25.93
				70	3.75	32.64	25.95
20112	...do...	42 22 N. 67 02 W.	Southeastern part of basin, north of Georges Bank	0	3.61	32.54	25.89
				20	3.39	32.52	25.90
				40	3.26	32.56	25.94
				100	3.15	32.86	26.18
				175	5.22	34.56	27.33
				225	4.66	34.70	27.50
				290	4.71	34.70	27.50
20113	...do...	42 53 N. 67 37 W.	Central part of basin	0	3.33	32.50	25.88
				20	2.88	32.47	25.90
				40	2.93	32.48	25.90
				100	4.32	33.51	26.59
				165	5.16	34.23	27.07
				230	5.16	34.43	27.23
20114	...do...	42 41 N. 68 40 W.	Near Cashes Ledge	0	3.33	32.41	25.81
				20	3.28	32.45	25.85
				40	2.91	32.43	25.87
				100	4.12	33.19	26.36
				175	4.96	34.18	27.05
20115	Apr. 18	42 37 N. 69 33 W.	Western side of basin, in offing of Cape Ann	0	3.61	32.45	25.81
				20	3.33	32.48	25.87
				40	3.20	32.47	25.87
				100	3.02	32.80	26.15
				150	5.38	33.69	26.62
				200	6.36	33.93	26.68
				290	4.92	34.34	27.19
20116	...do...	42 03 N. 69 38 W.	Off Cape Cod Highlands	0	3.61	32.14	25.57
				20	3.60	32.14	25.57
				40	3.13	32.16	25.63
				100	3.42	32.79	26.11
				195	4.25	33.91	26.91
20117	...do...	42 09 N. 69 58 W.	Off northern Cape Cod	0	3.61	31.87	25.36
				20	3.13	31.86	25.40
				40	3.00	32.08	25.58
				85	3.24	32.78	26.12
20118	Apr. 20	41 51 N. 70 18 W.	Cape Cod Bay	0	4.44	31.55	25.02
				15	3.76	31.52	25.07
				28	3.46	31.50	25.08
20119	...do...	42 18 N. 70 28 W.	Massachusetts Bay, midway between Cape Cod and Gloucester.	0	3.61	31.43	25.01
				20	2.87	31.56	25.18
				40	1.58	32.03	25.65
				90	1.78	32.29	25.84
20120	May 4	42 27 N. 70 25 W.	Mouth of Massachusetts Bay, off Gloucester	0	6.39	29.16	22.93
				5	6.12	29.11	22.93
				10	5.88	29.17	23.00
				15	5.90	29.18	23.00
				20	4.67	29.55	23.42
				30	4.52	31.13	24.69
				50	3.96	31.36	24.93
				70	2.72	---	---
20121	...do...	42 27 N. 70 25 W.	...do	0	5.56	29.08	22.96
				30	3.92	30.99	24.62
				60	2.39	32.24	25.76
20122	May 7–8	42 49 N. 70 37 W.	Off Merrimac River	0	7.22	28.26	22.18
				5	6.54	28.45	22.35
				10	5.61	30.59	24.14
				15	4.42	31.17	24.72
				20	4.18	31.24	24.81
				35	3.10	---	---
				50	3.13	32.17	25.63
				65	2.48	32.25	25.76
				85	2.30	32.38	25.86
20123	May 16	42 28 N. 70 43 W.	Massachusetts Bay, off Boston Harbor	0	8.89	29.94	23.20
				20	4.83	30.72	24.30
				55	2.35	32.18	25.73

TABLE 16.—"*Albatross*" *stations, 1920*—Continued

Station	Date	Position	General locality	Depth	Temperature	Salinity	Density
20124	May 16	42° 28′ N. 70° 18′ W.	Mouth of Massachusetts Bay, off Gloucester	0	9.72	29.87	23.02
				20	5.12	30.77	24.33
				40	2.89	32.07	25.58
				100	2.65	32.45	25.90
20125	do	42 00 N. 69 41 W.	Off Cape Cod highlands	0	9.17	30.25	23.40
				20	5.73	32.07	25.30
				40	3.78	32.34	25.71
				100	3.58	32.92	26.20
				140	4.04	33.21	26.38
20126	May 17	41 39 N. 69 22 W.	Offing of southern Cape Cod	0	8.33	31.53	24.52
				20	5.90	32.16	25.35
				40	4.30	32.54	25.82
				100	3.60	32.81	26.10
				160	4.10	33.49	26.60
20127	do	41 20 N. 69 06 W.	Basin east of Nantucket	0	7.22	31.89	24.93
				20	5.75	32.24	25.46
				40	4.10	------	------
				100	3.80	32.88	26.14
				145	3.80	32.98	26.24
20128	do	40 34 N. 68 53 W.	33 miles eastward from Nantucket Shoals Lightship	0	7.78	32.48	25.35
				20	5.55	32.47	25.63
				40	5.40	32.47	25.66
				70	5.04	32.50	25.71
20129	do	40 05 N. 69 04 W.	Continental edge off Nantucket Shoals	0	7.78	32.61	25.45
				10	7.56	32.61	25.48
				30	6.30	32.74	25.87
				90	7.32	33.84	26.48
				160	8.24	34.72	26.96

TABLE 17.—"*Fish Hawk*" *stations in Massachusetts and Ipswich Bays, December, 1924, to June, 1925*

[For key chart, see Bigelow, 1926, fig. 9]

Station	Position	General locality	Cruise	Date	Depth	Temperature	Salinity	Density
2	42° 12′ 00″ N. 70 23 30 W.	Mouth of the bay, 10 miles off Race Point, Cape Cod.	2	Dec. 11, 1924	0	6.75	------	------
					33	6.79	------	------
					66	6.85	------	------
			3	Dec. 16, 1924	0	5.95	------	------
					28	5.97	------	------
					56	5.95	------	------
			4	Dec. 22, 1924	0	4.90	------	------
					33	4.62	------	------
					64	4.90	------	------
			5	Jan. 6, 1925	0	4.05	------	------
					32	4.01	------	------
					64	4.15	------	------
			6	Feb. 6, 1925	0	2.00	[1]32.87	26.29
					32	1.81	[1]32.90	26.32
					63	3.10	[1]32.83	26.18
			7	Feb. 24, 1925	0	2.10	[1]32.75	26.19
					32	1.83	[1]32.71	26.28
					64	1.90	[1]33.07	26.46
			8	Mar. 10, 1925	0	2.40	[1]32.94	26.32
					33	2.14	[1]32.98	26.38
					65	2.05	[1]33.12	26.50
3	42 09 30 N. 70 19 30 W.	Mouth of the bay, 7 miles off Race Point, Cape Cod.	2	Dec. 11, 1924	0	6.50	------	------
					13	7.50	------	------
					26	6.55	------	------
			11	Apr. 7, 1925	0	4.10	------	------
					30	4.08	------	------
					60	3.40	------	------
			12	Apr. 22, 1925	0	5.50	[1]31.71	25.08
					17	5.49	[1]31.62	24.97
					33	3.79	[1]32.50	25.83
			13	May 21, 1925	0	8.50	[1]31.47	24.43
					15	8.14	[1]31.36	24.42
					30	5.15	[1]31.59	24.94
			14	June 17, 1925	0	12.13	32.38	24.57
					10	12.05	32.38	24.56
					20	9.23	32.52	25.03
					30	5.06	33.17	26.13

[1] From hydrometer reading.

TABLE 17.—"*Fish Hawk*" *stations in Massachusetts and Ipswich Bays, December, 1924, to June, 1925*—Continued

Station	Position	General locality	Cruise	Date	Depth	Temperature	Salinity	Density
4	42° 05′ 30″ N. 70° 17′ 00″ W.	3 miles off Race Point, Cape Cod	2	Dec. 11, 1924	0	6.70	--------	--------
					31	6.42	--------	--------
					62	6.90	--------	--------
			5	Jan. 6, 1925	0	3.65	--------	--------
					29	3.87	--------	--------
					58	4.05	--------	--------
			6	Feb. 6, 1925	0	0.60	[1]32.51	26.09
					30	0.60	[1]32.61	26.17
					60	1.00	[1]32.74	26.25
			11	Apr. 7, 1925	0	4.40	--------	--------
					30	4.20	--------	--------
					60	3.58	--------	--------
			12	Apr. 22, 1925	0	6.00	[1]31.87	25.11
					27	5.20	[1]31.76	25.14
					55	4.18	[1]32.32	25.68
			13	May 21, 1925	0	9.80	[1]31.58	24.33
					30	3.83	[1]32.36	25.73
					60	3.20	[1]32.35	25.77
			14	June 17, 1925	0	14.79	32.80	23.95
					10	14.35	32.30	24.05
					20	7.47	32.81	25.65
					40	3.75	33.24	26.43
					60	3.74	33.24	26.43
5	42° 00′ 45″ N. 70° 11′ 50″ W.	Close to Wood End, Cape Cod	2	Dec. 11, 1924	0	5.30	--------	--------
					20	5.43	--------	--------
					40	5.30	--------	--------
			3	Dec. 16, 1924	0	4.60	--------	--------
					21	4.93	--------	--------
					42	4.25	--------	--------
			5	Jan. 6, 1925	0	2.80	--------	--------
					19	2.85	--------	--------
					39	2.80	--------	--------
			6	Feb. 6, 1925	0	0.60	[1]32.43	--------
					20	0.14	--------	--------
					39	0.10	--------	--------
			7	Feb. 24, 1925	0	2.30	[1]32.29	25.94
					22	1.88	[1]32.61	26.09
					43	2.34	[1]32.99	26.37
6	41° 55′ 39″ N. 70° 09′ 30″ W.	Cape Cod Bay, off Wellfleet	3	Dec. 11, 1924	0	5.20	--------	--------
					13	5.34	--------	--------
					26	4.70	--------	--------
			4	Dec. 22, 1924	0	4.90	--------	--------
					14	4.55	--------	--------
					28	4.80	--------	--------
			5	Jan. 6, 1925	0	2.45	--------	--------
					12	2.48	--------	--------
					24	2.70	--------	--------
			6	Feb. 6, 1925	0	0.20	[1]32.25	25.90
					18	0.81	[1]32.29	25.89
					16	0.00	[1]32.57	26.16
			11	Apr. 8, 1925	0	4.90	--------	--------
					13	4.86	--------	--------
					26	5.14	--------	--------
			12	Apr. 22, 1925	0	6.80	[1]32.01	25.12
					15	4.63	--------	--------
					30	3.79	[1]32.21	25.62
			13	May 20, 1925	0	10.20	[1]31.63	24.31
					15	9.95	[1]31.65	24.36
					30	9.88	[1]31.78	24.48
6A	41° 56′ 00″ N. 70° 18′ 30″ W.	Central part, Cape Cod Bay	6	Feb. 6, 1925	0	−0.60	[1]32.62	26.21
					17	−1.55	[1]32.45	26.12
					34	−0.40	[1]32.74	26.32
			11	Apr. 8, 1925	0	4.75	[1]31.86	25.34
					22	4.40	--------	--------
					45	2.86	[1]32.30	25.77
			12	Apr. 22, 1925	0	6.60	[1]31.76	24.94
					17	5.77	[1]31.43	(?)
					35	4.98	[1]31.71	25.09
			13	May 20, 1925	0	10.20	[1]31.73	24.39
					17	--------	[1]31.44	--------
					34	4.62	[1]31.89	25.12
			14	June 16, 1925	0	15.01	31.80	23.53
					10	14.91	32.01	23.71
					20	8.47	32.38	25.71
					34	4.66	32.45	25.18

[1] From hydrometer reading.

TABLE 17.—"*Fish Hawk*" *stations in Massachusetts and Ipswich Bays, December, 1924, to June, 1925*—Continued

Station	Position	General locality	Cruise	Date	Depth	Temperature	Salinity	Density
7	41° 49' 30" N. 70° 11' 15" W.	South side, Cape Cod Bay	2	Dec. 9, 1924	0	6.30	--------	--------
					6	6.32	--------	--------
					12	6.30	--------	--------
			3	Dec. 11, 1924	0	4.25	--------	--------
					7	4.43	--------	--------
					14	4.35	--------	--------
			5	Jan. 7, 1925	0	0.30	--------	--------
					6	0.37	--------	--------
					13	0.25	--------	--------
			6	Feb. 6, 1925	0	−0.70	[1]32.35	26.02
					6	−0.41	[1]32.47	26.11
					11	−0.60	[1]32.66	26.23
			7	Feb. 24, 1925	0	1.60	[1]32.25	25.82
					6	1.48	[1]32.35	25.91
					12	1.39	[1]32.34	25.90
			11	Apr. 8, 1925	0	5.40	--------	--------
					6	5.24	--------	--------
					12	5.26	--------	--------
			12	Apr. 23, 1925	0	6.30	--------	--------
					6	--------	--------	--------
					12	6.48	--------	--------
			13	May 20, 1925	0	11.00	--------	--------
					6	10.96	--------	--------
					12	10.92	--------	--------
			14	June 16, 1925	0	15.23	32.23	23.81
					10	15.20	32.38	23.92
8	41° 49' 00" N. 70° 24' 30" W.	Cape Cod Bay, off Sandwich	1	Dec. 3, 1924	0	6.85	--------	--------
					23	6.80	--------	--------
9	41° 53' 15" N. 70° 27' 00" W.	West side, Cape Cod Bay	1	Dec. 3, 1924	0	6.93	--------	--------
					33	6.40	--------	--------
			2	Dec. 9, 1924	0	6.30	--------	--------
					14	6.73	--------	--------
					28	6.10	--------	--------
			3	Dec. 16, 1924	0	4.90	--------	--------
					17	4.93	--------	--------
					34	4.40	--------	--------
			4	Dec. 22, 1924	0	4.80	--------	--------
					17	4.83	--------	--------
					34	4.80	--------	--------
			5	Jan. 7, 1925	0	2.15	--------	--------
					16	2.20	--------	--------
					32	2.15	--------	--------
			6	Feb. 6, 1925	0	1.90	[1]32.70	26.21
					15	0.59	[1]32.78	26.34
					29	0.70	[1]33.19	26.63
10	41° 58' 00" N. 70° 30' 15" W.	Off Manomet, Plymouth, Mass.	1	Dec. 3, 1924	0	6.74	--------	--------
					33	6.80	--------	--------
			2	Dec. 9, 1924	0	6.90	--------	--------
					18	6.93	--------	--------
					36	7.10	--------	--------
			3	Dec. 17, 1924	0	5.40	--------	--------
					18	5.47	--------	--------
					36	5.90	--------	--------
			4	Dec. 22, 1924	0	4.60	--------	--------
					19	4.63	--------	--------
					37	4.80	--------	--------
			5	Jan. 7, 1925	0	2.25	--------	--------
					19	2.47	--------	--------
					37	2.15	--------	--------
			6	Feb. 7, 1925	0	1.00	[1]32.77	26.35
					18	0.87	[1]32.62	26.21
					35	0.80	[1]32.79	26.30
			7	Feb. 28, 1925	0	1.10	--------	--------
					19	1.43	--------	--------
					36	1.40	--------	--------
			8	Mar. 10, 1925	0	2.90	[1]32.66	26.12
					17	1.63	[1]32.61	26.11
					33	2.17	[1]32.52	26.00
			11	Apr. 8, 1925	0	4.10	[1]31.18	24.77
					20	4.59	--------	--------
					40	2.46	[1]32.26	25.76
			12	Apr. 23, 1925	0	5.60	[1]31.60	24.93
					22	5.54	--------	--------
					44	4.87	[1]31.66	25.06

[1] From hydrometer reading.

TABLE 17.—"*Fish Hawk*" *stations in Massachusetts and Ipswich Bays, December, 1924, to June, 1925*—Continued

Station	Position (° ′ ″)	General locality	Cruise	Date	Depth	Temperature	Salinity	Density
10	41 58 00 N. 70 30 15 W.	Off Manomet, Plymouth, Mass.	13	May 20, 1925	0	9.00	[1]31.76	24.62
					17	5.14	[1]31.56	24.96
					34	3.99	[1]31.92	25.37
			14	June 16, 1925	0	14.43	32.16	23.93
					10	12.83	32.23	24.31
					20	5.98	32.81	25.84
					38	5.69	32.95	25.99
11	41 59 30 N. 70 31 30 W.	Off Plymouth Harbor	1	Dec. 3, 1924	0	6.84	--------	--------
					35	6.85	--------	--------
			2	Dec. 9, 1924	0	6.80	--------	--------
					18	6.82	--------	--------
					36	6.70	--------	--------
			3	Dec. 17, 1924	0	5.40	--------	--------
					18	5.93	--------	--------
					36	6.10	--------	--------
			4	Dec. 23, 1924	0	4.50	--------	--------
					18	4.63	--------	--------
					35	4.60	--------	--------
			5	Jan. 7, 1925	0	2.00	--------	--------
					18	2.00	--------	--------
					35	1.15	--------	--------
11A	42 00 00 N. 70 32 15 W.	do	6	Feb. 7, 1925	0	1.10	[1]32.67	26.19
					18	1.01	[1]32.97	26.44
					36	1.20	[1]32.92	26.39
12	42 01 15 N. 70 33 00 W.	do	1	Dec. 3, 1924	0	6.51	--------	--------
					27	6.40	--------	--------
			2	Dec. 9, 1924	0	6.90	--------	--------
					14	6.42	--------	--------
			3	Dec. 17, 1924	0	5.60	--------	--------
					13	5.62	--------	--------
					26	6.05	--------	--------
			4	Dec. 23, 1924	0	--------	--------	--------
					16	4.63	--------	--------
					31	3.50	--------	--------
			5	Jan. 7, 1925	0	2.15	--------	--------
					13	1.67	--------	--------
					26	1.55	--------	--------
13	42 03 00 N. 70 34 30 W.	Off Gurnet Point	1	Dec. 3, 1924	0	5.83	--------	--------
					20	5.80	--------	--------
			2	Dec. 9, 1924	0	5.85	--------	--------
					17	5.73	--------	--------
					34	5.50	--------	--------
			3	Dec. 17, 1924	0	5.80	--------	--------
					12	5.83	--------	--------
					24	5.05	--------	--------
			4	Dec. 23, 1924	0	2.50	--------	--------
					13	4.54	--------	--------
					25	4.50	--------	--------
			5	Jan. 7, 1925	0	2.00	--------	--------
					13	1.90	--------	--------
					25	1.90	--------	--------
13A	42 02 30 N. 70 34 00 W.	do	6	Feb. 7, 1925	0	1.20	[1]32.81	26.30
					16	1.10	[1]32.94	26.41
					32	1.10	[1]33.04	26.50
			7	Feb. 28, 1925	0	1.21	--------	--------
					15	1.13	--------	--------
					30	1.21	--------	--------
			8	Mar. 10, 1925	0	1.70	--------	--------
					13	1.64	--------	--------
					25	1.45	--------	--------
			11	Apr. 8, 1925	0	5.40	--------	--------
					12	4.63	--------	--------
					24	3.81	--------	--------
14	42 05 00 N. 70 35 00 W.	Off Green Habor	1	Dec. 3, 1924	0	5.13	--------	--------
					18	4.90	--------	--------
			2	Dec. 9, 1924	0	5.90	--------	--------
					13	5.87	--------	--------
					26	5.80	--------	--------
				Dec. 17, 1924	0	4.60	--------	--------
					11	4.51	--------	--------
					22	4.20	--------	--------

[1] From hydrometer reading.

TABLE 17.—"*Fish Hawk*" *stations in Massachusetts and Ipswich Bays, December, 1924, to June, 1925*—Continued

Station	Position	General locality	Cruise	Date	Depth	Temperature	Salinity	Density
14	42° 05′ 00″ N. 70° 35′ 00″ W.	Off Green Harbor	4	Dec. 23, 1924	0	4.50	--------	--------
					8	2.56	--------	--------
					16	3.90	--------	--------
			5	Jan. 7, 1925	0	2.15	--------	--------
					13	2.23	--------	--------
					25	2.05	--------	--------
			6	Feb. 7, 1925	0	−0.10	[1]32.72	26.29
					11	−0.20	[1]32.98	--------
					22	0.20	[1]32.78	26.33
			11	Apr. 8, 1925	0	5.10	--------	--------
					10	5.22	--------	--------
					20	4.65	--------	--------
			12	Apr. 23, 1925	0	5.30	31.9	--------
					10	5.10	31.7	--------
					20	4.60	31.7	--------
			13	May 20, 1925	0	8.80	[1]31.85	24.49
					10	8.84	--------	--------
					20	4.69	[1]31.87	25.20
			14	June 16, 1925	0	15.21	32.09	23.70
					10	10.66	32.38	24.79
					20	7.56	32.66	25.52
15	42° 09′ 30″ N. 70° 38′ 15″ W.	Off Marshfield	1	Dec. 3, 1924	0	4.82	--------	--------
					20	4.80	--------	--------
			2	Dec. 9, 1924	0	4.95	--------	--------
					12	4.93	--------	--------
					24	4.90	--------	--------
			3	Dec. 17, 1924	0	4.25	--------	--------
					10	4.25	--------	--------
					20	4.25	--------	--------
			4	Dec. 23, 1924	0	3.50	--------	--------
					12	4.54	--------	--------
					24	3.00	--------	--------
			5	Jan. 7, 1925	0	2.05	--------	--------
					10	2.47	--------	--------
					20	2.95	--------	--------
			6	Feb. 7, 1925	0	0.00	[1]32.67	26.25
					12	−0.50	[1]32.63	26.24
					23	2.03	[1]32.91	26.33
			7	Feb. 28, 1925	0	1.21	--------	--------
					12	1.21	--------	--------
					22	1.30	--------	--------
			8	Mar. 10, 1925	0	2.00	[1]32.43	25.94
					11	1.67	[1]32.47	26.00
					21	1.95	[1]32.58	26.07
16	42° 14′ 00″ N. 70° 41′ 00″ W.	Off Scituate	1	Dec. 3, 1924	0	5.62	--------	--------
					24	5.80	--------	--------
			2	Dec. 9, 1924	0	5.65	--------	--------
					12	5.62	--------	--------
					24	6.10	--------	--------
			3	Dec. 17, 1924	0	3.80	--------	--------
					13	4.50	--------	--------
					26	4.80	--------	--------
			4	Dec. 23, 1924	0	4.50	--------	--------
					13	4.54	--------	--------
					25	4.50	--------	--------
			5	Jan. 7, 1925	0	2.70	--------	--------
					10	2.70	--------	--------
					20	2.70	--------	--------
			6	Feb. 7, 1925	0	0.00	[1]32.54	26.14
					12	−0.10	[1]32.92	26.45
					24	0.50	[1]32.95	26.45
			11	Apr. 8, 1925	0	5.05	--------	--------
					15	4.93	--------	--------
					30	3.52	--------	--------
			12	Apr. 23, 1925	0	5.70	[1]31.55	24.87
					12	5.10	[1]31.62	25.02
					24	4.58	[1]31.66	25.11
			14	June 16, 1925	0	15.17	32.09	23.70
					10	15.14	32.09	23.72
					26	6.76	32.66	25.62
17	42° 18′ 15″ N. 70° 44′ 00″ W.	Off Minots Light	1	Dec. 3, 1924	0	6.83	--------	--------
					38	6.90	--------	--------
			2	Dec. 9, 1924	0	6.50	--------	--------
					18	6.42	--------	--------
					36	6.50	--------	--------
			3	Dec. 16, 1924	0	5.15	--------	--------
					16	5.34	--------	--------
					32	5.20	--------	--------

[1] From hydrometer reading.

TABLE 17.—"*Fish Hawk*" *stations in Massachusetts and Ipswich Bays, December, 1924, to June, 1925*—Continued

Station	Position	General locality	Cruise	Date	Depth	Temperature	Salinity	Density
17	42° 18′ 15″ N. 70° 44′ 00″ W.	Off Minots Light	4	Dec. 22, 1924	0	4.90	--------	--------
					19	4.53	--------	--------
					35	4.50	--------	--------
			12	Apr. 23, 1925	0	5.60	[1]31.60	24.95
					17	5.13	[1]31.70	25.09
					35	4.60	[1]31.60	25.02
			13	May 20, 1925	0	8.70	[1]31.60	24.53
					16	5.00	[1]31.96	25.30
					32	3.68	[1]32.20	25.46
			14	June 16, 1925	0	15.00	32.23	23.86
					10	14.32	32.16	23.94
					20	7.27	32.66	25.56
					37	4.65	32.95	26.11
18	42° 15′ 30″ N. 70° 32′ 30″ W.	Central part of Massachusetts Bay	3	Dec. 16, 1924	0	5.40	--------	--------
					30	5.49	--------	--------
					60	5.45	--------	--------
			4	Dec. 22, 1924	0	4.50	--------	--------
					32	5.03	--------	--------
					64	4.50	--------	--------
			5	Jan. 6, 1925	0	3.50	--------	--------
					32	3.57	--------	--------
					63	4.35	--------	--------
18A	42° 17′ 00″ N. 70° 30′ 30″ W.	do	6	Feb. 6, 1925	0	2.00	[1]33.01	26.40
					34	1.85	[1]33.08	26.48
					68	2.00	--------	--------
			7	Feb. 24, 1925	0	2.00	[1]33.14	26.51
					35	1.70	[1]32.51	26.12
					70	2.20	[1]33.10	26.45
			8	Mar. 10, 1925	0	1.90	[1]32.90	26.32
					38	1.88	[1]32.91	26.33
					76	1.85	[1]33.01	26.41
			12	Apr. 23, 1925	0	6.40	[1]31.86	25.05
					35	4.00	[1]32.00	25.38
					70	2.88	[1]32.48	25.92
			13	May 20, 1925	0	8.15	[1]31.50	24.53
					40	3.71	[1]32.29	25.68
					80	3.08	[1]32.38	25.81
			14	June 16, 1925	0	15.22	[2]32.33	--------
					10	13.88	[2]32.16	--------
					20	6.11	32.95	25.94
					40	3.55	33.39	26.57
					79	3.23	33.24	26.48
19	42° 22′ 00″ N. 70° 38′ 00″ W.	Off Boston Harbor	5	Jan. 6, 1925	0	3.95	--------	--------
					29	3.97	--------	--------
					58	4.10	--------	--------
			6	Feb. 6, 1925	0	2.60	[1]33.13	26.44
					35	2.06	[1]33.26	26.60
					70	2.60	[1]33.18	26.66
20	42° 44′ 00″ N. 70° 36′ 45″ W.	Ipswich Bay	9	Mar. 12, 1925	0	3.50	[1]31.47	25.07
					32	2.60	[1]32.94	26.31
					64	2.70	[1]33.11	26.42
21	42° 46′ 00″ N. 70° 40′ 00″ W.	do	9	do	0	3.60	[1]30.71	24.44
					21	2.81	[1]33.08	26.39
					41	2.45	[1]33.19	26.50
			10	Mar. 25, 1925	0	3.80	--------	--------
					32	2.71	--------	--------
					64	2.82	--------	--------
			11	Apr. 7-8, 1925	0	4.90	[1]28.75	22.76
					20	2.62	--------	--------
					39	2.61	[1]31.80	25.38
22	42° 47′ 45″ N. 70° 43′ 30″ W.	do	9	Mar. 12, 1925	0	3.80	[1]32.41	25.77
					15	2.46	[1]32.86	26.25
					30	2.44	[1]32.94	26.31
			10	Mar. 25, 1925	0	3.60	--------	--------
					20	2.72	--------	--------
					39	2.48	--------	--------
23	42° 49′ 30″ N. 70° 40′ 00″ W.	do	10	do	0	3.70	--------	--------
					40	--------	--------	--------
					79	2.89	--------	--------
			11	Apr. 7-8, 1925	0	4.60	--------	--------
					37	2.43	--------	--------
					75	2.48	--------	--------

[1] From hydrometer reading.

[2] These water samples probably were transposed.

TABLE 17.—"*Fish Hawk*" *stations in Massachusetts and Ipswich Bays, December, 1924, to June, 1925*—Continued

Station	Position	General locality	Cruise	Date	Depth	Temperature	Salinity	Density
24	42° 50′ 30″ N. 70° 43′ 30″ W.	Ipswich Bay	10	Mar. 25, 1925	0	3.60	--------	--------
					16	2.73	--------	--------
					33	2.57	--------	--------
25	42° 52′ 00″ N. 70° 40′ 00″ W.	do	9	Mar. 12, 1925	0	3.60	[1] 31.47	25.04
					25	2.40	[1] 32.47	26.16
					49	2.44	[1] 33.02	26.39
			10	Mar. 25, 1925	0	3.80	--------	--------
					38	2.63	--------	--------
					75	2.90	--------	--------
			11	Apr. 7-8, 1925	0	4.75	--------	--------
					33	2.87	--------	--------
					65	2.78	--------	--------
26	42° 53′ 30″ N. 70° 43′ 00″ W.	do	9	Mar. 12, 1925	0	3.70	[1] 31.03	24.68
					17	2.36	[1] 32.81	26.22
					33	2.40	[1] 32.94	26.32
			10	Mar. 25, 1925	0	3.40	--------	--------
					12	3.27	--------	--------
					24	2.64	--------	--------
27	42° 54′ 30″ N. 70° 40′ 00″ W.	do	10	do	0	3.35	--------	--------
					38	2.63	--------	--------
					76	2.85	--------	--------
28	42° 56′ 00″ N. 70° 41′ 45″ W.	do	9	Mar. 12, 1925	0	3.10	[1] 32.10	25.59
					22	2.60	[1] 32.70	26.10
					43	2.60	[1] 33.21	26.52
			10	Mar. 25, 1925	0	3.60	--------	--------
					18	2.83	--------	--------
					37	2.59	--------	--------
			11	Apr. 7-8, 1925	0	4.20	[1] 29.02	23.04
					26	2.57	--------	--------
					51	2.61	[1] 33.15	26.47
29	42° 38′ 00″ N. 70° 33′ 30″ W.	Off Thatcher's Island	11	Apr. 8, 1925	0	4.55	--------	--------
					20	2.83	--------	--------
					39	2.81	--------	--------
			12	Apr. 22, 1925	0	4.20	[1] 31.13	24.72
					22	4.23	--------	--------
					44	3.56	[1] 32.00	25.47
			13	May 21, 1925	0	7.10	[1] 31.44	--------
					32	3.38	[2] 32.61	--------
					64	3.21	[2] 32.42	--------
			14	June 17, 1925	0	12.91	32.09	24.19
					10	12.24	32.09	24.30
					20	11.87	32.09	24.37
					48	5.19	32.88	26.00
30	42° 38′ 00″ N. 70° 25′ 00″ W.	Offing of Cape Ann	11	Apr. 8, 1925	0	4.30	--------	--------
					42	3.13	--------	--------
					84	3.11	--------	--------
			12	Apr. 22, 1925	0	4.00	[1] 31.79	25.26
					40	3.42	[1] 32.38	25.75
					80	2.92	[1] 32.82	26.17
			13	May 22, 1925	0	9.40	[1] 31.11	24.05
					25	3.51	[1] 32.21	25.65
					50	3.30	[1] 32.21	25.66
			14	June 17, 1925	0	13.33	32.38	24.31
					10	12.08	32.66	24.78
					20	6.39	32.95	25.91
					40	4.23	33.24	26.38
					75	4.04	33.24	26.40
31	42° 30′ 00″ N. 70° 20′ 00″ W.	On line Cape Ann-Cape Cod	11	Apr. 7, 1925	0	4.05	[1] 32.02	25.45
					57	2.86	--------	--------
					112	2.90	[1] 32.59	26.00
			12	Apr. 22, 1925	0	4.40	[1] 31.30	24.83
					42	2.63	[1] 32.47	25.92
					84	2.70	[1] 32.81	26.24
			13	May 21, 1925	0	9.40	[1] 31.27	24.17
					81	3.12	--------	--------
					162	3.10	[1] 32.59	25.98
			14	June 17, 1925	0	12.94	32.66	24.61
					10	9.11	32.74	25.35
					20	5.45	33.10	26.14
					40	4.00	33.17	26.35
					94	3.47	33.24	26.49

[1] From hydrometer reading. [2] Probably transposed.

TABLE 17.—"*Fish Hawk*" *stations in Massachusetts and Ipswich Bays, December, 1924, to June, 1925*—Continued

Station	Position	General locality	Cruise	Date	Depth	Temperature	Salinity	Density
32	42° 23′ 00″ N.; 70° 15′ 00″ W.	Midway between Cape Cod and Cape Ann	11	Apr. 7, 1925	0	4.40	--------	--------
					30	3.33	--------	--------
					60	2.72	--------	--------
			12	Apr. 22, 1925	0	4.30	[1]31.47	24.98
					25	4.11	[1]31.66	25.16
					50	3.00	[1]32.41	25.84
			13	May 21, 1925	0	9.20	[1]31.66	24.50
					35	3.40	[1]32.41	25.77
					70	3.09	[1]32.56	25.95
			14	June 17, 1925	0	12.43	32.52	24.61
					10	9.62	32.59	25.16
					29	4.56	33.39	26.47
					50	3.97	33.17	26.53
33	42 15 00 N.; 70 10 00 W.	North of Cape Cod	11	Apr. 7, 1925	0	4.60	[1]31.91	25.00
					40	3.69	--------	--------
					80	2.91	[1]33.18	26.46
			12	Apr. 22, 1925	0	4.40	[1]32.00	25.39
					32	4.18	[1]32.57	25.87
					64	3.06	[1]32.65	26.01
			13	May 21, 1925	0	8.30	[1]31.74	24.68
					25	5.04	[1]32.26	25.54
					50	3.28	[1]32.52	25.91
			14	June 17, 1925	0	12.94	32.59	24.56
					10	11.81	32.45	24.65
					20	5.20	33.17	26.22
					50	4.09	33.17	26.34
34	42 08 00 N.; 70 06 00 W.	Off Cape Cod	11	Apr. 7, 1925	0	4.40	[1]32.01	25.39
					22	2.94	--------	--------
					44	3.12	[1]32.68	26.05
			12	Apr. 22, 1925	0	4.50	[1]31.86	25.26
					25	4.02	[1]32.01	25.44
					50	3.48	[1]32.91	26.22
			13	May 21, 1925	0	9.00	[1]31.59	24.48
					28	4.30	[1]32.29	25.62
					56	3.31	[1]32.36	25.77
			14	June 17, 1925	0	12.11	32.59	24.72
					10	11.06	32.38	24.75
					20	5.56	33.03	26.06
					56	3.91	33.10	26.29
35	42 34 30 N.; 70 38 00 W.	Off Eastern Point, Gloucester	12	Apr. 21, 1925	0	4.40	[1]31.26	24.81
					22	4.23	[1]31.66	25.14
					44	3.66	[1]31 86	25.34
			13	May 22, 1925	0	8.00	[1]31.47	24.54
					22	3.78	[1]32.05	25.48
					44	3.31	[1]32.74	26.06
			14	June |17, 1925	0	13.16	32.09	24.13
					10	12.72	32.16	24.27
					20	12.03	32.30	24.50
					40	6.14	32.66	24.70
36	42 30 15 N.; 70 43 15 W.	North side of Massachusetts Bay, off Bakers Island.	12	Apr. 23, 1925	0	5.20	[1]31.50	25.06
					22	4.83	[1]31.70	25.12
					44	3.95	[1]31.70	25.15
			13	May 22, 1925	0	6.95	[1]31.87	24.99
					23	3.99	[1]32.51	25.78
					46	3.72	[1]32.47	25.82
			14	June 17, 1925	0	13.53	32.23	24.16
					10	12.15	32.38	24.54
					20	12.06	32.66	24.81
					44	4.61	32.88	26.[illegible]6
37	42 28 00 N.; 70 48 00 W.	Off Marblehead	12	April 23, 1925	0	4.20	[1]31.59	25.[illegible]8
					19	4.83	[1]31.75	25.16
					38	4.60	[1]32.00	25.38
			13	May 22, 1925	0	8.72	[1]31.71	24.60
					20	4.39	--------	--------
					39	3.69	--------	--------
			14	June 17, 1925	0	12.16	32.38	24.56
					10	10.24	32.45	24.94
					20	9.08	32.66	25.30
					42	5.30	32.88	25.98
38	42 24 15 N.; 70 52 15 W.	Off Nahant	12	April 23, 1925	0	6.00	[1]31.47	24.79
					13	4.57	[1]31.40	24.90
					26	4.75	[1]32.09	25.30
			13	May 22, 1925	0	9.25	[1]31.35	24.24
					15	4.33	[1]32.02	25.41
					30	3.86	--------	--------
			14	June 17, 1925	0	12.76	32.16	24.27
					10	9.75	32.52	25.08
					20	8.93	32.52	25.22
					28	5.92	32.81	25.85

[1] From hydrometer reading.

TABLE 18.—*Temperatures taken from the "Halcyon" in 1925, stations not numbered*

Date	Latitude	Longitude	General locality	Depth	Temperature
	° ′ ″	° ′ ″			
Apr. 17	42 41 30	70 28 30	4 miles northeast (mag.) from Cape Ann whistling buoy	0	5.50
				48	2.90
18	43 40 00	69 47 00	At Seguin Island whistling buoy	0	4.40
				29	2.40
19	44 04 00	68 08 00	7 miles off Great Duck Island, off Mountain Desert Island	0	3.10
				18	3.05
				37	2.98
				55	2.80
				91	2.87
June 4	43 08 00	69 40 00	Platts Bank	0	10.00
				18	5.80
				36	4.50
				55	4.20
				73	4.10
7	41 42 00	69 48 00	6 miles east of Chatham	0	12.70
				42	6.54
7	41 25 45	69 42 00	1 mile south-southeast from Round Shoal whistling buoy	0	8.30
				29	8.36
11	41 28 30	69 34 00	7 miles east from Round Shoal whistling buoy	0	11.60
				37	6.34
July 9	44 10 15	68 16 30	1 mile west from Little Duck Island, Me	0	8.80
				29	7.85
13	44 20 45	67 56 30	3½ miles west from Petit Manan Lighthouse	0	10.50
				37	7.76
15	44 13 15	68 14 30	2½ miles north-northeast from Little Duck Island	0	11.90
				21	8.70
18	----------	----------	¼ mile northeast from White Island, Me	0	13.30
				42	6.72
20	43 08 30	69 40 30	Platts Bank	0	18.80
				37	7.90
				80	4.48
22	43 35 00	70 07 00	Cod Ledges (off Portland, Me.)	0	14.40
				20	8.52
23	43 07 45	70 25 40	Between Boone Island Lighthouse and whistling buoy	44	5.48
Aug. 7	44 11 15	68 14 25	½ mile northeast from Little Duck Island	0	11.10
				9	9.10
				27	8.96
20	41 27 00	69 43 00	Round Shoal whistling buoy	0	11.60
				13	11.36
				22	11.20
21	41 27 00	69 41 15	1 mile east from Round Shoal whistling buoy	0	11.60
				9	11.58
				20	11.60
21	41 28 20	69 40 20	2 miles east-northeast from Round Shoal whistling buoy	0	11.60
				15	11.50
				26	11.70
21	41 25 30	69 41 20	1½ miles south-southeast from Round Shoal whistling buoy	0	13.30
				24	13.20
23	41 21 00	69 42 50	1 mile northeast from Rose and Crown buoy	0	16.40
				22	15.56
21	41 25 30	69 42 20	1 mile south of Round Shoal buoy	0	15.00
				26	13.18
23	41 07 15	69 42 45	Great Rip whistling buoy, Mass	0	14.10
				22	14.42
24	41 07 15	69 42 45	do	0	13.80
				13	14.22
				24	14.25
24	41 08 00	69 37 00	4 miles east from Great Rip whistling buoy	0	13.80
				15	14.06

TABLE 18.—*Temperatures taken from the "Halcyon" in 1925, stations not numbered*—Continued

Date	Latitude			Longitude			General locality	Depth	Temperature
	°	′	″	°	′	″			
Aug. 24	41	10	00	69	40	00	Off Great Rip	22	14.40
26	42	18	00	70	19	30	Stellwagen Bank	0 18 35	16.60 12.06 7.07
Sept. 2	42	47	00	70	19	00	Northwest prong of Jeffreys Ledge	0 27 51	16.60 8.68 5.95
3	43	07	00	69	37	30	Platts Bank	0 18 37 70	15.20 9.34 6.14 5.90
3	43	18	30	69	40	00	Between Platts Bank and Portland, Me	0 166	14.70 4.90 5.00
4							1½ miles east-southeast from White Island, Me	0 26 31	13.30 10.20 9.72
5	43	07	45	70	25	45	Between Boone Island Lighthouse and whistling buoy	0 51	15.50 7.38
9	44	11	15	68	15	00	¼ mile north of Little Duck Island, Me	0 18	11.10 10.23
10	44	13	15	68	13	15	2¾ miles northeast of Little Duck Island, Me	0 18 33	10.80 10.80 10.10
14	44	21	30	67	54	00	1½ miles west of Petit Manan Lighthouse	0 18 42	10.50 10.50 10.16
15	43	58	00	68	08	30	Mount Desert Rock	0 18 37 80	9.30 9.26 8.50 7.96
15	44	04	00	68	07	00	Off Mount Desert Rock	0 18 37 55 91	9.80 9.36 9.08 8.76 8.72
16	44	05	00	68	26	30	Off Swans Island whistling buoy, Me	0 18 49	10.80 9.72 9.42
Oct. 1	41	21	45	69	42	00	2 miles northeast of Rose and Crown buoy	0 13 26	12.20 12.70 12.78
1	41	25	00	69	42	00	1½ miles south of Round Shoal buoy	0 13 24	11.60 12.00 12.00
1	41	24	00	69	37	00	5 miles southeast of Round Shoal buoy	0 13 26	11.60 11.86 13.54
14	44	09	00	68	18	00	¾ mile northeast from Drum Ledge buoy, Mount Desert	0 31	10.50 8.98
15	44	12	50	68	13	00	2½ miles northeast from Little Duck Island	0 9 27	10.80 9.26 9.16
16	44	09	30	68	12	00	2 miles southeast from Little Duck Island	0 18 37	10.30 8.74 8.74
22	41	25	30	69	42	30	Round Shoal whistling buoy 1 mile south	0 11 22	10.80 9.44 9.38
27	41	17	45	71	00	00	Vineyard Sound whistling buoy	0 16 33	13.30 11.90 11.86

TABLE 18.—*Temperatures taken from the "Halcyon" in 1925, stations not numbered*—Continued

Date	Latitude	Longitude	General locality	Depth	Temperature
	° ′ ″	° ′ ″			
27	41 11 00	71 28 00	21 miles east of Block Island	0	13.00
				11	11.18
				22	11.72
28	41 11 40	70 51 15	½ mile west of No Mans Land gas and whistling buoy	0	13.30
				18	12.10

TABLE 19.—*"Albatross II" stations, 1926*

Station	Date	Position	General locality	Depth	Temperature[1]	Salinity	Density
		° ′					
20200	Aug. 11	42 30 N. 70 17 W.	Off Gloucester	0	18.00	31.89	22.93
				20	9.30	32.60	25.21
				40	5.80	32.82	25.88
				100	4.75	32.83	26.01
				180	4.72	32.86	26.03
20201	Aug. 12	42 12 N. 69 13 W.	Offing of Cape Cod	0	19.40	---------	---------
				20	9.65	32.85	25.36
				40	4.71	33.05	26.19
				100	3.70	33.37	26.55
				150	4.57	---------	---------
				190	5.00	33.94	26.85
20202	...do....	41 48 N. 68 10 W.	Northwest edge of Georges Bank	0	15.00	32.59	24.24
				15	12.25	32.93	24.96
				35	10.60	32.97	25.28
				55	7.45	---------	---------
20203	Aug. 13	42 06 N. 67 18 W.	North edge of Georges Bank	0	14.70	32.70 to 32.98	---------
				20	11.00		---------
				40	10.30		---------
				60	8.30		---------
20204	...do....	42 07 N. 66 40 W.	Northeast edge of Georges Bank	0	17.77	32.45	23.39
				20	10.95	32.84	25.12
				40	7.80	32 91	25.68
				70	6.30	33.04	25.99
20205	Aug. 14	41 51 N. 66 18 W.	East end of Georges Bank	0	17.20	32.59	23.66
				20	12.02	32.78	24.88
				40	8.90	32.93	25.53
				60	8.80	32.96	25.57
20206	Aug. 15	41 58 N. 66 26 W.	Northeast part of Georges Bank	0	16.94	32.57	23.69
				20	11.30	32.68	24.94
				40	7.60	33.04	25.81
				60	6.10	33.07	26.03
20207	Aug. 17	41 53 N. 66 22 W.	East end of Georges Bank	0	15.50	32.60	24.03
				20	14.70	32.66	24.25
				40	10.05	32.95	25.36
				70	7.95	33.06	25.78
20208	Aug. 18	41 46 N. 66 26 W.	...do	0	15.83	32.60	24.11
				20	11.80	32.82	24.95
				40	10.00	32.89	25.32
				60	9.10	32.94	25.51
20209	Aug. 19	42 28 N. 67 05 W.	Southeast part of basin, north of Georges Bank	0	16.60	32.54	23.74
				20	16.70	32.54	23.72
				40	13.10	32.80	24.69
				100	5.70	33.83	26.69
				200	6.60	34.79	27.33
				300	6.40	34.86	27.41
20210	Aug. 20	43 11 N. 67 41 W.	Basin, offing of Mount Desert	0	16.60	32.73	23.88
				20	15.90	32.78	24.08
				40	6.60	33.08	24.98
				100	4.50	33.57	26.62
				200	5.80	34.15	26.93
20211	...do....	43 50 N. 68 33 W.	Near Mount Desert Rock	0	14.17	---------	---------
				20	12.15	32.96	25.00
				40	9.20	33.06	25.59
				100	5.60	---------	---------
				150	6.05	34.15	26.90

[1] Probable error ±0.1°.