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CURRENTS IN NARRAGANSETT BAY BUZZARDS BAY, AND NANTUCKET AND VINEYARD SOUNDS

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PREFACE

In the preparation of this volume, the aim has been to collect, correlate, and present in usable form the mass of data derived from current observations taken at various times in Narragansett Bay, Buzzards Bay, Vineyard Sound, and Nantucket Sound, to the end that basic material in the files of the Coast and Geodetic Survey may be available for the use of the many individuals and interests desiring it, and at the same time be insured against loss or destruction to which all unpublished records are liable.

Most of the results presented are based upon observations taken in connection with surveying operations of the Coast and Geodetic Survey. They date back to the year 1844 and include data from recent comprehensive current surveys covering the waterways mentioned above. Some of the observational material was furnished by, or obtained in cooperation with, other organizations. Special acknowledgment is made to the United States Army Engineers who furnished data for a number of current stations in the Cape Cod Canal, and to the Lighthouse Service which cooperated in securing long series of current observations at a number of lightships. The section on the general characteristics of tidal currents, which in this volume precedes the discussion of the currents in the several waterways, was taken from "Tides and Currents in New York Harbor," U. S. Coast and Geodetic Survey Special Publication No. 111, Revised (1935) Edition.

In connection with this publication, attention is directed to the annual Current Tables, Atlantic Coast, North America. These tables contain data from which daily predictions of the currents may be readily obtained for numerous locations in the areas covered by this volume.

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DEFINITIONS

Tidal currents are the horizontal movements of the water that accompany the rising and falling of the tide. The horizontal movement of the tidal current and the vertical movement of the tide are intimately related parts of the same phenomenon brought about by the tide-producing forces of sun and moon. Tidal currents, like the tides, are therefore periodic.

It is the periodicity of the tidal current that chiefly distinguishes it from other kinds of currents in the sea, which are known by the general name of nontidal currents. These latter currents are brought about by causes that are independent of the tides, such as winds, fresh-water run-off, and differences in density and temperature. Currents of this class do not exhibit the periodicity of tidal currents.

Tidal and nontidal currents occur together in the open sea and in inshore tidal waters, the actual current experienced at any point being the resultant of the two classes of currents. In some places tidal currents predominate and in others nontidal currents predominate. Tidal currents generally attain considerable velocity in narrow entrances to bays, in constricted parts of rivers, and in passages from one body of water to another. Along the coast and farther offshore tidal currents are generally of moderate velocity; and in the open sea, calculation based on the theory of wave motion, gives a tidal current of less than one-tenth of a knot.

REVERSING TIDAL CURRENTS

In the entrance to a bay or in a river and, in general, where a restricted width occurs, the tidal current is of the reversing or rectilinear type; that is, the flood current runs in one direction for a period of about 6 hours and the ebb current for a like period in the opposite direction. The flood current is the one that sets inland or upstream and the ebb current the one that sets seaward or downstream. The change from flood to ebb gives rise to a period of slack water during which the velocity of the current is zero. An example of this type of current is shown in figure 1, which represents the velocity and direction of the current as observed on August 8–9, 1922, in the Narrows, the entrance to New York Harbor.

The curve of figure 1 was drawn by plotting the velocity of the current as observed at the beginning of each hour and drawing a smooth curve that conformed as nearly as possible with the plotted velocities. The northerly setting or flood velocities were plotted above the line of zero velocity and the southerly setting or ebb velocities were plotted below this line. The velocities are given in knots, which is the unit generally used in measuring tidal currents, and represents a velocity of 1 nautical mile per hour. Since a nautical mile has a length of 6,080 feet, knots may be converted into statute miles per hour by multiplying by 1.15, or into feet per second by multiplying by 1.69.

The curve of the reversing current resembles the tide curve. The maximum velocity of the flood current, called the strength of flood, corresponds to the high water of the tide curve, while the maximum velocity of the ebb, called the strength of ebb, corresponds to the low water. The current day, like the tidal day, has a length averaging 24 hours and 50 minutes.

The current curve shown in figure 1 represents the current near the surface in the axis of the channel of the Narrows. From observation and also from theory it is known that the tidal current extends from the surface to the bottom. In general it may be said that the velocity of the tidal current decreases from the surface to the bottom, the velocity near the bottom being about two thirds that at the surface. But the effects of wind and fresh-water flow may bring about considerable variation in the vertical velocity distribution.

The current in a channel is also characterized by a variation in the horizontal distribution of velocity. In a rectangular channel of uniform cross-section, the velocity is greatest in the center of the channel, and decreases uniformly to both sides. Combining both the vertical and horizontal variations, it may be said that the average velocity of the current in a section of a regular channel is about three-quarters that of the central surface velocity.

Where the current is undisturbed by wind or fresh-water flow, the flood and ebb velocities, and the durations of flood and ebb are approximately equal. In this case, too, the characteristics of the current from the surface to the bottom are much the same. That is, the strengths of the flood and ebb currents, and also the slacks, occur at about the same time from top to bottom. If, however, nontidal currents are present, the characteristics of the tidal flow are modified considerably. The effect of nontidal currents on tidal currents may be derived from general considerations.

In figure 2 a purely tidal current is represented by the curve, referred to the line *AB* as the line of zero velocity. The strengths of the flood and ebb are equal, as are also the durations of flood and ebb. In this case slack water occurs regularly 3 hours and 6 minutes (one-quarter of the current cycle of 12 hours and 25 minutes) after the times of flood and ebb strengths. If now a nontidal current is introduced which sets in the ebb direction with a velocity represented by the line *CD*, the strength of ebb will obviously be increased by an amount equal to *CD* and the flood strength will be decreased by the same amount. The current conditions may now be represented by drawing, as the new line of zero velocities, the line *EF* parallel to *AB*, and distant from it the length of *CD*.

Figure 2 now shows that the nontidal current not only increases the ebb strength while decreasing the flood strength, but also changes the times of slack water. Slack before flood now comes later, while slack before ebb comes earlier. Hence the duration of ebb is increased while the duration of flood is decreased.

If the velocity of the nontidal current exceeds that of the tidal current at time of strength, the tidal current in the opposite direction will be completely masked and the resultant current will set at all times in the direction of the nontidal current. Thus, if in figure 2 the line *OP* represents the velocity of the nontidal current, the new axis for measuring the velocity of the combined current at any time will be the line *GH* and the current will be flowing at all times in the

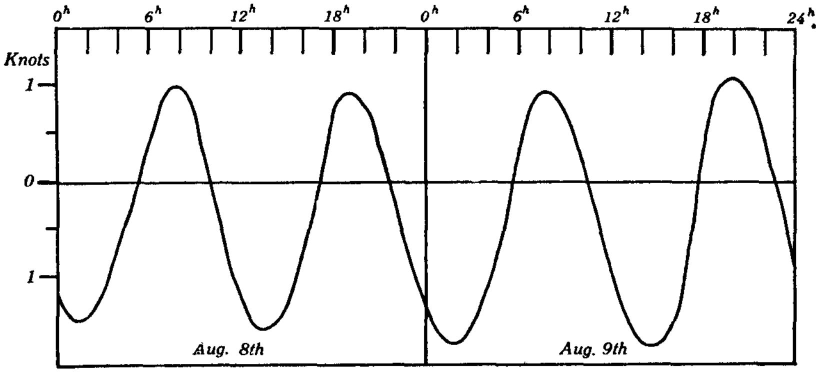

FIGURE 1.—Current curve, the Narrows, New York Harbor, August 8–9, 1922.

ebb direction. There will be no slack waters; but at periods 6 hours 12 minutes apart there will occur minimum and maximum velocities represented, respectively, by the lines *RS* and *TU*.

Insofar as the effect of the nontidal current on the direction of the tidal current is concerned, it is only necessary to remark that the resultant current will set in a direction which at any time is the result-

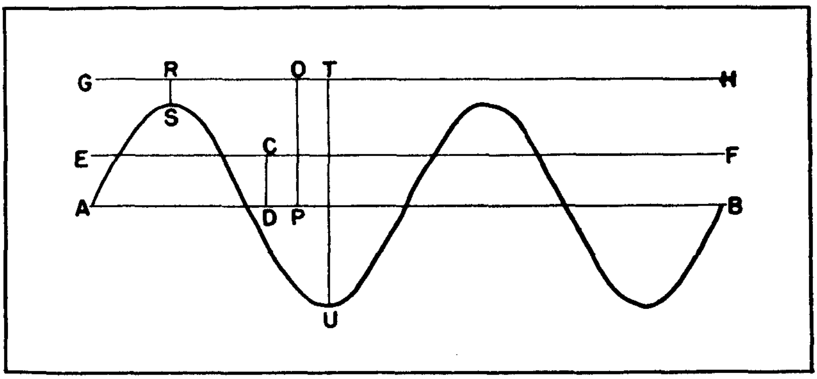

FIGURE 2.—Effect of nontidal current on reversing tidal current.

ant of the tidal and nontidal currents at that time. This resultant direction and also the resultant velocity may be determined either graphically by the parallelogram of velocities or by the usual trigonometric computations.

VARIATIONS IN STRENGTH OF CURRENT

Tidal currents exhibit periodic changes in the strength of the current that correspond closely with the periodic changes in range exhibited by tides. Stronger currents than usual come with the spring tides of full and new moon and the weaker currents with the neap tides of the moon's first and third quarters. Likewise, perigean tides are accompanied by strong currents and apogean tides by relatively weaker currents; and when the moon has considerable declination, the currents, like the tides, are characterized by diurnal inequality.

As related to the moon's changing phases, the variation in the strength of the current from day to day is approximately proportional to the corresponding change in the range of the tide. The moon's changing distance likewise brings about changes in the velocity of the strength of the current which is approximately proportional to the corresponding change in the range of the tide; but in regard to the moon's changing declination, tide and current do not respond alike, the diurnal variation in the tide at any place being generally greater than the diurnal variation in the current.

The relations subsisting between the changes in the velocity of the current at any given place and the range of the tide at that place may be derived from general considerations of a theoretical nature. Variations in the current that involve semidiurnal components will approximate corresponding changes in the range of the tide; but for variations involving diurnal components the variation in the current is about half that in the tide.

TYPES OF REVERSING CURRENTS

Since tides and tidal currents are merely different aspects of the tidal movement of the waters, the former being the vertical movement and the latter the horizontal movement, it is to be expected that tidal currents would show different types, corresponding to the different types of tide. And observations prove this to be the case. Reversing currents may be readily classed under the three types of semidaily, daily, and mixed. The semidaily type is one in which two flood strengths and two ebb strengths occur in a tidal day, with but little inequality between morning and afternoon currents. Figure 1, illustrating the current in the Narrows, New York Harbor, may be taken as representative of this type.

The daily type of tidal current is characterized by one flood and one ebb in a day. The upper diagram of figure 3, which represents the current as observed in the entrance to Mobile Bay, Ala., on May 2–3, 1918, exemplifies this type of current. The mixed type of tidal current exhibits two floods and two ebbs in a day with considerable inequality between the forenoon and afternoon cycles. The lower diagram of figure 3, which represents the current observed in Rich Passage, Puget Sound, Wash., on March 29–30, 1917, illustrates this type of current.

In general, it may be said that with reversing currents a given type of current accompanies a like type of tide; that is, semidaily currents occur with semidaily tides, mixed currents with mixed tides, and daily currents with daily tides. But as noted in considering the variations in strength of current, the variations in the current that involve semidaily components will approximate corresponding changes in the range of the tide, while in those involving daily components the variation in the current is about half that in the tide. Hence the diurnal inequality in the current at any place is generally less than in the tide at that place.

RELATION OF TIME OF CURRENT TO TIME OF TIDE

In simple wave motion the times of slack and strength of current bear a constant and simple relation to the times of high and low waters. In a progressive wave the time of slack water comes, theoretically, exactly midway between high and low water and the time of strength at high and low water; in a stationary wave slack comes at the times of high and low water, while the strength of current comes midway between high and low water.

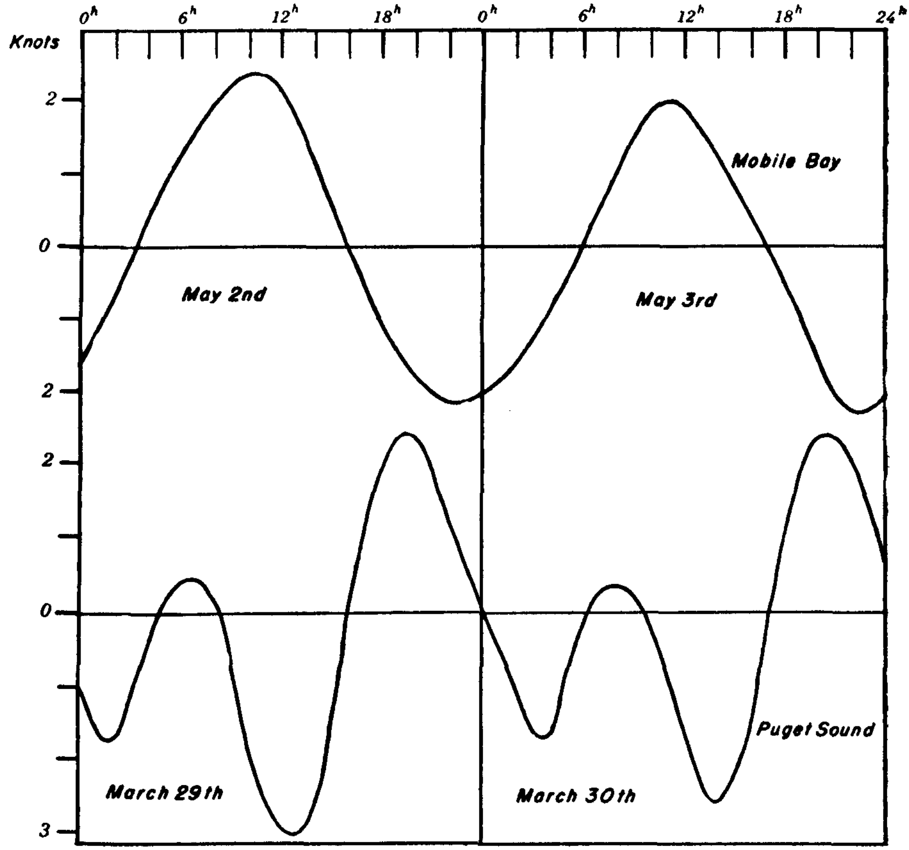

FIGURE 3.—Current curves of daily and mixed types of reversing currents.

The progressive-wave movement and the stationary-wave movement are the two principal types of tidal movements. A progressive wave is one whose crest advances, so that in any body of water that sustains this type of tidal movement the times of high and low water progress from one end to the other. A stationary wave is one that oscillates about an axis, high water occurring over the whole area on one side of this axis at the same instant that low water occurs over the whole area on the other side of the axis.

The tidal movements of coastal waters are rarely of simple wave form; nevertheless, it is very convenient in the study of currents to refer the times of current to the times of tide. And where the diurnal inequality in the tide is small, as is the case on the Atlantic coast, the relation between the time of current and the time of tide is very nearly constant. This is brought out in figure 4, which represents the tide and current curves in the Narrows, New York Harbor, for August 8–9, 1922, the current curve being the dashed-line curve, representing the velocities of the current in the center of the channel, and the tide curve being the full-line curve, representing the rise and fall of the tide at Fort Hamilton, on the eastern shore of the Narrows.

The diagrams of figure 4 were drawn by plotting the heights of the tide and the velocities of the current to the same time scale and to such velocity and height scales as will make the maximum ordinates of the two curves approximately equal. The time axis or axis of X represents the line of zero velocity for the currents and of mean sea level for the tide, the velocity of the current being plotted in accordance with the scale of knots on the right, while the height of the tide reckoned from mean sea level was plotted in accordance with the scale in feet on the left.

From figure 4 it is seen that the corresponding features of the tide and current at this station bear a nearly constant time relation to each other. This approximate constancy in time relations between current and tide is characteristic of tidal waters in which the diurnal inequality is small, and permits the times of slack and of strength of the current to be referred to the times of high and low water. Thus, from figure 4 we find that the strengths of the current come about an hour before the times of high and low water, while the slacks come about 1¾ hours after high water and 3 hours after low water. In this connection, however, it is to be noted that the time relations between corresponding phases of tide and current at any place frequently vary in consequence of disturbing effects of wind, weather, and fresh-water run-off.

Quite apart from the disturbing effects of nontidal agencies, the time relations between current and tide are subject to variations in regions where the tide exhibits considerable diurnal inequality; as for example, on the Pacific coast of the United States. This variation is due to the fact, previously mentioned, that the diurnal inequality in the current at any given place is, in general, only about half as great as that in the tide. This brings about differences in the corresponding features of tide and current as between morning and afternoon. However, in such cases it is frequently possible to refer the current at a given place to the tide at some other place with comparable diurnal inequality.

DISTANCE TRAVELED DURING A TIDAL CYCLE

The vertical distance traveled by a floating object during the tidal cycle at any place can be easily determined from the tide curve at that place. For the tide curve represents the successive heights of the surface of the water during the tidal cycle. Hence the vertical distance on the tide curve between a high water and low water gives the vertical distance through which a floating object moved during that tidal cycle.

The close resemblance between the curve of the reversing current and the tide curve might lead one to conclude that from the current curve the horizontal distance traveled by a floating object can be as readily derived as the vertical distance is from the tide curve. The current curve, however, gives the successive speeds of the horizontal movement, and not the successive positions of a floating object.

Hence the current curve does not give directly the horizontal distance traveled by a floating object.

If the velocity of the current during a tidal cycle were constant, the horizontal distance traveled by the water particles or by any object floating in the water would be given by multiplying the velocity by the period of duration. The velocity of the current, however, is not constant but changes continually throughout a tidal cycle. The distance traveled by the water particles is therefore the average velocity during the flood or ebb period in question, multiplied by the duration.

The average velocity of the current during any given interval may be determined in several different ways. By measuring the velocity

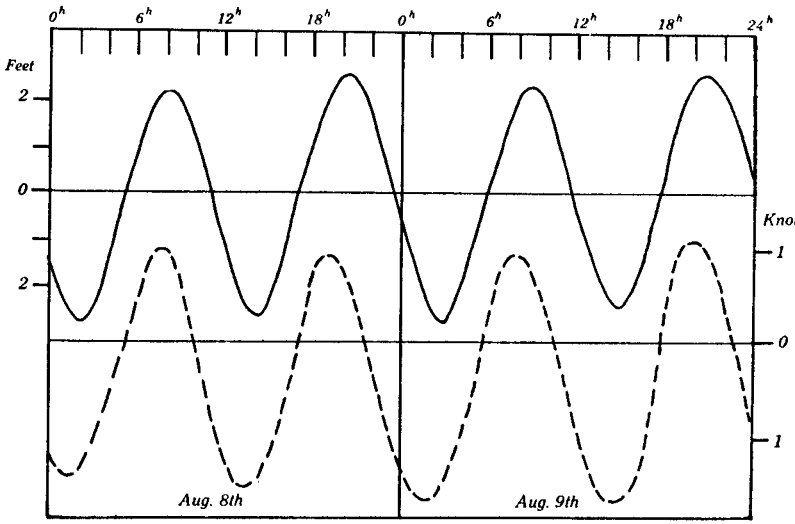

FIGURE 4.—Tide and current curves, the Narrows, New York Harbor, August 8-9, 1922.

on the current curve at frequent intervals, say every 10 or 15 minutes, the average velocity during the interval is easily derived. Or the area of the surface bounded by the current curve and the zero line of velocities may be determined by means of a planimeter and the average velocity derived by dividing this area by the length of the zero line included within the current curve.

The simplest method, however, consists in making use of the fact that the current curve approximates the cosine curve. And on the cosine curve it is known that the ratio of the mean ordinate to the maximum ordinate is $2 \div \pi$, or 0.637. Since the strength of the tidal current corresponds to the maximum ordinate, it follows that during any given flood or ebb period the average velocity will be the strength of the current multiplied by 0.637.

In the semidaily or mixed types of current the duration of a flood or ebb period approximates 6.2 hours. Hence, in the case of such a current which has a velocity at strength of one knot, a floating object will, during a flood or ebb period, be carried a distance of $0.637 \times 6.2 = 3.95$ nautical miles, or 24,000 feet. In a daily current of the same strength the distance will be twice as great.

It may be noted that the formula made use of in the preceding calculation can give only approximate results. For not only is the average current derived through the cosine relationship approximate, but what may be even more serious is the fact that in the formula it is assumed that the floating object during the various stages of its journey will experience the changes in velocity which occur at the point where it started. Where more exact results are desired, corrections to the above approximate results can be applied.

If the durations of flood and ebb are equal, and also the strengths of the flood and ebb currents, a floating object would be carried a given distance downstream and a like distance upstream. The presence of fresh water in tidal waterways, however, makes both the strength and duration of the ebb greater than the flood, and therefore floating objects tend to be carried out to sea.

DURATION OF SLACK

In the change of direction of flow from flood to ebb, and vice versa, the reversing tidal current goes through a period of slack water or zero velocity. Obviously, this period of slack is but momentary, and graphically it is represented by the instant when the current curve cuts the zero line of velocities. For a brief period each side of slack water, however, the current is very weak, and in ordinary usage "slack water" denotes not only the instant of zero velocity but also the period of weak current. The question is therefore frequently raised, How long does slack water last?

To give slack water in its ordinary usage a definite meaning, we may define it to be the period during which the velocity of the current is less than one-tenth of a knot. Velocities less than one-tenth of a knot may generally be disregarded for practical purposes, and such velocities are, moreover, difficult to measure either with float or with current meter. For any given current it is now a simple matter to determine the duration of slack water, the current curve furnishing a ready means for this determination.

In general, regarding the current curve as approximately a sine or cosine curve, the duration of slack water is a function of the strength of current—the stronger the current the less the duration of slack—and from the equation of the sine curve we may easily compute the duration of slack water for currents of various strengths. For the normal flood or ebb cycle of 6^h 12.6^m we may write the equation of the current curve $y=A \sin 0.4831t$, in which A is the velocity of the current in knots at time of strength, 0.4831 the angular velocity in degrees per minute, and t is the time in minutes from the instant of zero velocity. Setting $y=0.1$ and solving for t (this value of t giving half the duration of slack) we get for the duration of slack the following values: For a current with a strength of 1 knot, slack water is 24 minutes; for currents of 2 knots strength, 12 minutes; 3 knots, 8 minutes; 4 knots, 6 minutes; 5 knots, 5 minutes; 6 knots, 4 minutes; 8 knots, 3 minutes; 10 knots, 2½ minutes. For the daily type of current with a given strength, the duration of slack is obviously twice that of a semidaily current with like strength.

VELOCITY OF CURRENT AND PROGRESSION OF TIDE

In the tidal movement of the water it is necessary to distinguish clearly between the velocity of the current and the progression or rate of advance of the tide. In the former case reference is made to the actual speed of a moving particle, while in the latter case the reference is to the rate of advance of the tide phase or the velocity of propagation of wave motion, which generally is many times greater than the velocity of the current.

It is to be noted that there is no necessary relationship between the velocity of the tidal current at any place and the rate of advance of the tide at that place. In other words, if the rate of advance of the tide is known we cannot from that alone infer the velocity of the current, nor vice versa. The rate of advance of the tide in any given body of water depends on the type of tidal movement. In a progressive wave the tide moves approximately in accordance with the formula $r=\sqrt{gh}$, in which r is the rate of advance of the tide, g the acceleration of gravity, and h the depth of the waterway. In stationary-wave movement, since high or low water occurs at very nearly the same time over a considerable area, the rate of advance is theoretically very great; but actually there is always some progression present, and this reduces the theoretical velocity considerably.

The velocity of the current, or the actual speed with which the particles of water are moving past any fixed point, depends on the volume of water that must pass the given point and the cross section of the channel at that point. The velocity of the current is thus independent of the rate of advance of the tide.

ROTARY TIDAL CURRENTS

Within the channel of a bay or river, the current is compelled to follow the direction of the channel, upstream on the flood and downstream on the ebb. Out in the open sea, however, this restriction no longer exists, the current having complete freedom so far as direction is concerned. Offshore, therefore, tidal currents are generally not of the reversing type. Instead of flowing in the same general direction during the entire period of the flood and in the opposite direction during the ebb, the tidal currents offshore change direction continually. Such currents are therefore called rotary currents. An example of this type of current is shown in figure 5, which represents the velocity and direction of the current at the beginning of each hour of the forenoon of July 30, 1922, at Nantucket Shoals Lightship, stationed off the coast of Massachusetts.

The current is seen to have changed its direction at each hourly observation, the rotation being in the direction of movement of the hands of a clock, or from north to south by way of east, then to north again by way of west. In a period of a little more than 12 hours it is seen that the current has shifted in direction completely round the compass.

It will be noted that the tips of the arrows, representing the velocities and directions of the current at the beginning of each hour. define a somewhat irregular ellipse. If a number of observations are averaged, eliminating accidental errors and temporary meteorological disturbances, the regularity of the curve is considerably increased. The average period of the cycle is, from a considerable number of observations, found to be $12^h\ 25^m$. In other words, the current day for the rotary current, like the tidal day, is $24^h\ 50^m$ in length.

A characteristic feature of the rotary current is the absence of slack water. Although the current generally varies from hour to hour, this variation from greatest current to least current and back again to greatest current does not give rise to a period of slack water. When the velocity of the rotary tidal current is least, it is known as the minimum current, and when it is greatest it is known as the maximum current. The minimum and maximum velocities of the rotary current are thus related to each other in the same way as slack and strength of the rectilinear current, a minimum velocity following

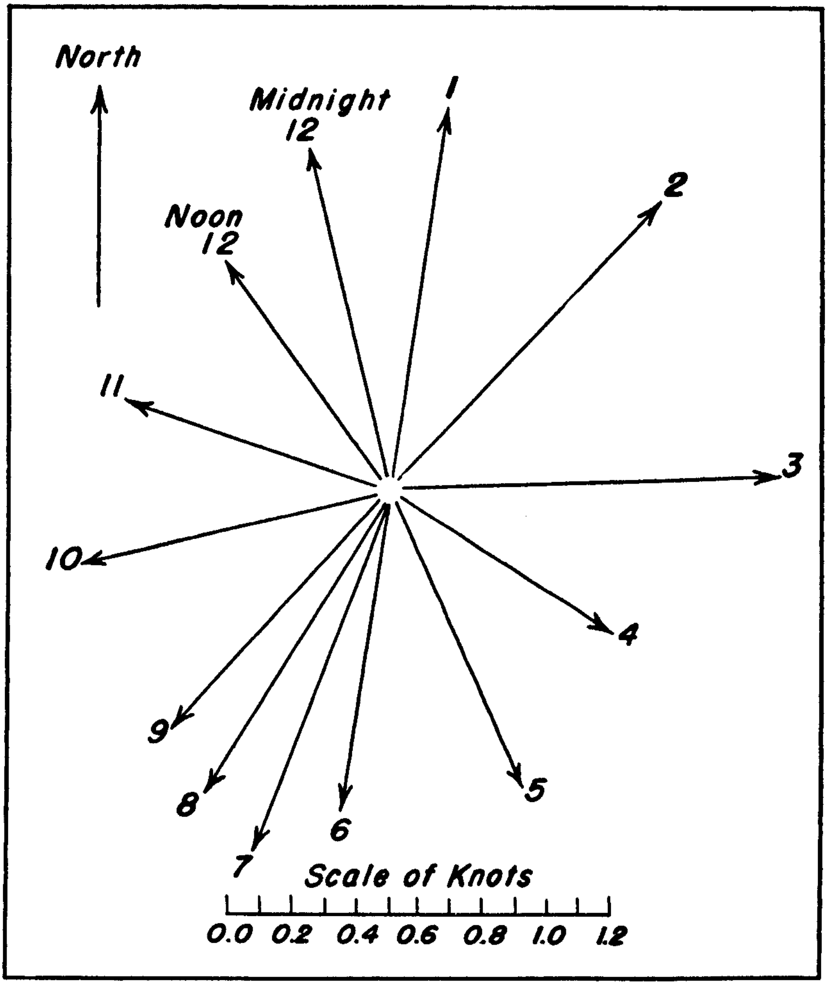

FIGURE 5.—Rotary current, Nantucket Shoals Lightship, forenoon of July 30, 1922.

a maximum velocity by an interval of about 3 hours and being followed in turn by another maximum after a further interval of 3 hours.

Since the current day corresponds to the tidal day, it is convenient, in determining the average hourly velocity and direction of the rotary current, to make use of the times of high and low water at some nearby place for purpose of reference. In figure 6 the average hourly velocity and direction of the tidal current at Nantucket Shoals Lightship is shown with reference to the times of high and low water at Boston, Mass., *H* standing for the time of high water, and *L* for the time of low water.

In figure 6 the velocity and direction of the current at the beginning of each hour is given by the length and direction of the line from the center of the ellipse to the hour in question. Thus at the time of high water at Boston the current at Nantucket Shoals Lightship has a velocity averaging 0.7 knot, setting N. 85° E.

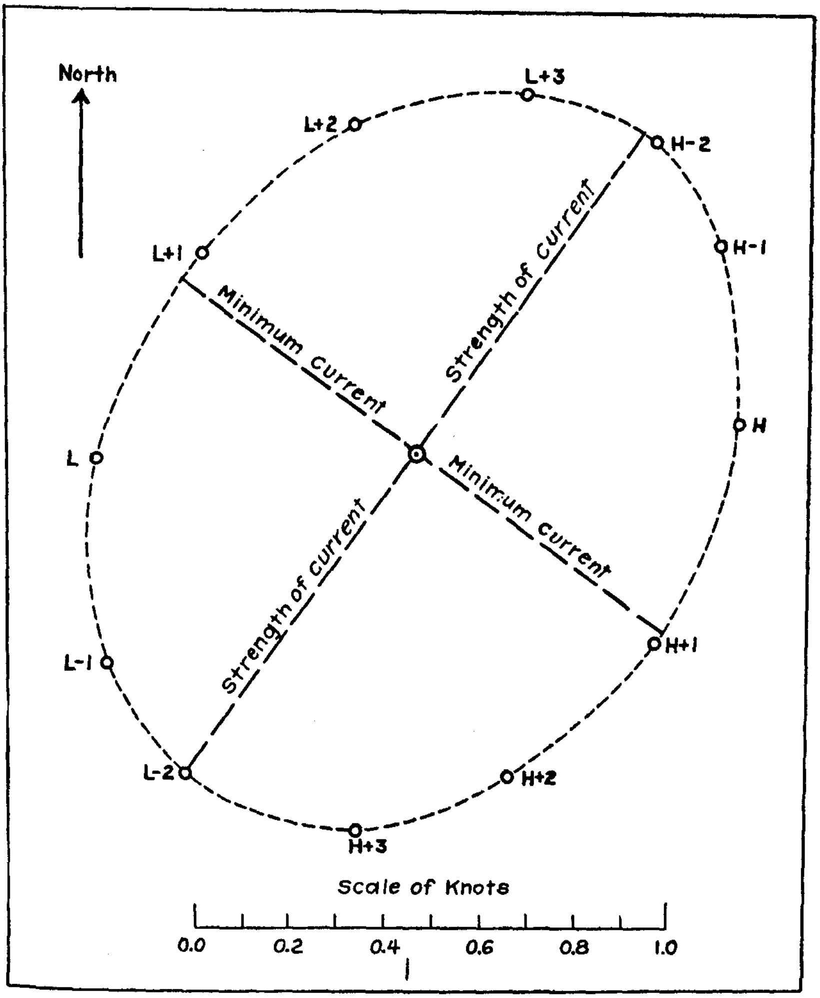

FIGURE 6.—Mean current curve, Nantucket Shoals Lightship.

With regard to the current curve, or current ellipse as it may be called, which represents the rotary tidal current at any place, the basic features are the relation of the major and minor axes which determine the ellipticity of the curve, the direction of rotation, and the direction of the major axis. If the major and minor axes are nearly equal the ellipse will be nearly circular; if they differ greatly the ellipse will be flattened. In the northern hemisphere the direction of rotation of the rotary current is, as a rule, with the hands of a clock, while in the southern hemisphere it is counter clockwise. But local hydrographic features may bring about a reversal of this general rule.

Rotary tidal currents are subject to the periodic variations found in tides and reversing currents. These variations are related to the changes in the phase, parallax, and declination of the moon. At times of full and new moon the velocity of the rotary current is greater than the average, while at the times of the moon's first and third quarters the velocities are less than the average. Likewise when the moon is in perigee, stronger currents occur, while when the moon is in apogee the currents are weaker. In general it may be taken that the percentage of increase or decrease in the velocity of the current in response to changes in phase and parallax is the same as the like increase or decrease in the local range of the tide.

In response to changes in the declination of the moon the rotary current exhibits diurnal inequality like the tide and reversing current. This manifests itself as a difference between morning and afternoon current ellipses. When the moon is on the equator the two current ellipses of a day are much alike; but when the moon is near its maximum semimonthly declination the two current ellipses exhibit differences, principally in velocity.

Like tides and reversing currents, rotary tidal currents may be grouped under the three types of semidaily, daily, and mixed. The semidaily type of rotary current is one which exhibits two full cycles within a tidal day, morning and afternoon currents differing but little. The daily type is one in which but one cycle occurs in a day; and the mixed type is one which exhibits two cycles within a day, but with considerable differences between morning and afternoon currents.

EFFECTS OF NONTIDAL CURRENTS ON ROTARY CURRENTS

In addition to the periodic variations to which rotary tidal currents are subject, they also exhibit fluctuations arising from the effects of nontidal currents. These effects can most conveniently be studied diagrammatically.

Figure 6 represents the purely rotary tidal current at Nantucket Shoals Lightship. Now suppose that on a given day a wind begins blowing from the northeast such that it produces a wind-driven current of half a knot in a southwesterly direction. For that day, obviously, the velocity and direction of the current at Nantucket Shoals Lightship will be different than represented in figure 6. At 2 hours before low water at Boston, for example, the tidal current sets southwesterly with a velocity of 0.85 knot on the average; but with a nontidal current due to the wind of 0.5 knot setting in the same direction, the velocity of the current now experienced will be $0.85+0.50=1.35$ knots, setting southwesterly. On the other hand, about 2 hours before high water, the current will be setting $0.85-0.50=0.35$ knot northeasterly.

The current conditions at this time may be completely represented by changing the origin of the hourly velocity and direction lines in figure 6 from the center to a point 0.5 knot northeasterly of its previous position. The lines drawn to the various hourly points on the ellipse from this new origin will now represent the velocity and direction of the tidal current as affected by the nontidal current.

The average velocity of the tidal current at the times of flood or ebb strength at Nantucket Shoals Lightship is 0.85 knot. If the nontidal current due to the wind in the case just considered is greater than 0.85 knot, the origin of the velocity lines would lie outside the ellipse. In that case the current would throughout the day be setting either southeasterly or southwesterly, completely masking the rotary character of the tidal current. By plotting the observed hourly velocities and directions of the current, however, the tidal current would appear in its rotary character. This is illustrated in figure 7 for the current at Frying Pan Shoal Lightship under different wind conditions. This lightship is stationed off the coast of North Carolina about 20 miles southeasterly from Cape Fear. The hourly velocity and direction of the current here is referred to the times of high and low water at Charleston, S. C.

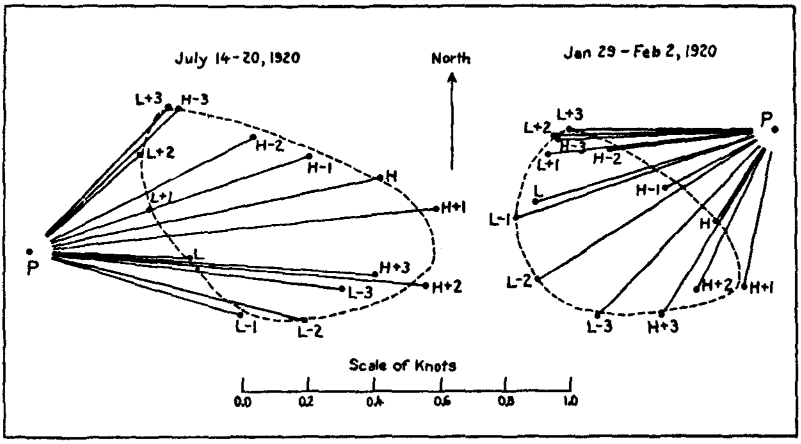

FIGURE 7.—Effect of nontidal current on rotary tidal current, Frying Pan Shoals Lightship.

Observations made at this lightship show the tidal current here to be rotary clockwise, the average velocity at strengths of flood and ebb being about a third of a knot and setting northwest and southeast, respectively. During the 5-day period January 29–February 2, 1920, the wind was blowing steadily from the northeast with a velocity of about 30 miles per hour, and the current was observed to be setting at all times southwesterly with a velocity varying from a little less than one half a knot to a little more than three-quarters of a knot. Apparently the current here at this time was altogether nontidal. But if the hourly velocity and direction of the current during this period is plotted, the rotary character of the current is immediately apparent. The right-hand diagram of figure 7 represents the current conditions during this 5-day period, the velocity and direction of the current at the different hours being given by the length and direction of the lines drawn from the point P.

Now, although the current at all times during this period set southwesterly, the diagram reveals clearly the existence of a rotary current with a strength of about a third of a knot in a northwest and southeast direction. Furthermore, the diagram shows that the current actually observed consisted of a tidal current which was masked by a nontidal current of greater velocity. In fact the diagram permits the evaluation of this nontidal current. For this must clearly be given by the line joining the point P_4 with the center of the current ellipse, and this is found to have a length of about half a knot and a direction of S. 60° W. This nontidal current was brought about by the northeasterly wind during the 5-day period in question.

About 6 months later, throughout the 7-day period July 14–20, 1920, the current at Frying Pan Shoals Lightship was found to set easterly with velocities ranging from a little less than half a knot to more than a knot. On plotting the observations, as the left-hand diagram of figure 7 shows, the rotary character of the tidal current comes to light at once. During this 7-day period the wind was blowing steadily from the southwest with a velocity averaging approximately 30 miles per hour. This brought about a wind-driven current setting a little north of east with a velocity somewhat greater than half a knot, and this completely masked the tidal current.

HARMONIC CONSTANTS

The reversing tidal current, like the tide, may be regarded as the resultant of a number of simple harmonic movements, each of the form $y=A \cos (at+\alpha)$; hence, reversing tidal currents may be analyzed in a manner analogous to that used in tides and the harmonic current constants derived. These constants permit the characteristics of the currents to be determined in the same manner as the tidal harmonic constants, and they may also be used in the prediction of the times of slack and the times and velocities of the strength of current.

It can easily be shown that in inland tidal waters, like rivers and bays, the amplitudes of the various current components are related to each other, not as the amplitudes of the corresponding tidal components, but as these latter multiplied by their respective speeds; that is, in any given harbor, if we denote the various components of the current by primes and of the tide by double primes, we have

$$M'_2 \colon S'_2 \colon N'_2 \colon K'_1 \colon O'_1 \colon = m_2M''_2 \colon s_2S''_2 \colon n_2N''_2 \colon k_1K''_1 \colon o_1O''_1$$

where the small italic letters represent, respectively, the angular speed of the corresponding components. This shows at once that the diurnal inequality in the currents should be approximately half that in the tide.

Rotary currents may likewise be analyzed harmonically, but in this case it is necessary to resolve the hourly velocity and direction of the current into two components, one in the north-and-south direction and the other in the east-and-west direction. Each set of hourly tabulations is then treated independently and analyzed in the usual manner. When the two sets of harmonic constants have been derived the like-named constants of the north-and-south and east-and-west directions may be combined into a single resultant, which will be an ellipse.

MEAN VALUES

In the nonharmonic analysis of current observations it is customary to refer the times of slack and strength of current to the times of high and low water of the tide at some suitable place, generally nearby. In this method of analysis the time of current determined is in effect reduced to approximate mean value, since the changes in the tidal current from day to day may be taken to approximate the corresponding changes in the tide; but the velocity of the current as determined from a short series of observations must be reduced to a mean value.

In the ordinary tidal movement of the progressive or stationary wave types the change in the strength of the current from day to day may be taken approximately the same as the variation in the range of the tide. Hence, the velocity of the current from a short series of observations may be corrected to a mean value by multiplying by a factor which is the ratio of the mean range of the tide to the range for the period of the observations.

It is to be noted that in this method of reducing to a mean value, any nontidal currents must first be eliminated, and the factor applied to the tidal current alone. This may be done by taking the strengths of the tidal current as the half sum of the flood and ebb strengths for the period in question.

In some places the current, while exhibiting the characteristic features of the tidal current, is in reality a hydraulic current due to differences in head at the ends of a strait connecting two independent tidal bodies of water. East River and Harlem River in New York Harbor and Seymour Narrows in British Columbia are examples of such straits, and the currents sweeping through these waterways are not tidal currents in the true sense, but hydraulic currents. The velocities of such currents vary as the square root of the head, and hence in reducing the velocities of such currents to a mean value the factor to be used is the square root of the factor used for ordinary tidal currents.

Part I—NARRAGANSETT BAY

INTRODUCTION

For the purpose of this publication Narragansett Bay is assumed to include the intercommunicating system of waterways that discharges into the sea through the navigable entrances between Point Judith and Sakonnet Point in the State of Rhode Island. Conanicut Island and Rhode Island separate the southern portion of this water area into three passages known as Western Passage, Eastern Passage, and Sakonnet River.

A number of smaller islands are distributed over the bay, and many small bays and river entrances indent its shores. Of the tributary streams the two most important are Providence River and Taunton River which flow into the northern and eastern parts of the bay, respectively. The various passages serve as highways for waterborne traffic to and from the numerous cities and towns situated on the bay. Of major importance are the ports of Newport, about 3 miles inside the entrance to Eastern Passage; Providence, at the head of Providence River about 27 miles from the ocean; and Fall River, at the mouth of Taunton River about 18 miles from Newport.

Vessels of 18-foot draft can dock at Newport, and dredged channels having least depths of 30 feet at mean low water lead to Providence and Fall River. Seekonk River, a continuation of Providence River, is navigable to Pawtucket 4½ miles above its mouth for vessels drawing 14 feet. Taunton River has a least depth of 5 feet at mean low water to the head of navigation at Taunton which is 12½ miles above Fall River.

The tidal movement in Narragansett Bay with its vertical and horizontal constituents—tide and current, respectively—is a continuation of the tide wave of the Atlantic Ocean which sweeps into the three entrances between Sakonnet Point and Point Judith and continues up the bay and into each of its tributaries until stopped by rapids or other obstructions. As is usual when oceanic tidal movements enter inland waterways, the nature of the movement is modified by the hydrographic features encountered, and in this area the local features are such that the current movement in particular is subjected to considerable distortion. A study of the observational data to be presented will lead to some conclusions relative to the nature of this distortion.

OBSERVATIONS

Current observations in Narragansett Bay and its immediate approaches, as recorded in the files of the Coast and Geodetic Survey, began in the year 1844, when two current stations were occupied just outside the entrance to the bay by G. S. Blake, who was conducting a hydrographic survey in that area. Thirty years later, in 1874, H. L. Marindin secured brief series of current observations at a number of stations in Providence Harbor in connection with a physical survey of that waterway. He also observed the times of 58 slack waters in the Seekonk River, off India Point. In 1889, J. E. Pillsbury, while surveying a speed course, observed currents at four stations in the Eastern Passage of Narragansett Bay.

Through a cooperative arrangement between the Bureau of Lighthouses and the Coast and Geodetic Survey, continuous hourly observations of the direction and velocity of the current at Brenton Reef Lightship in the approach to Eastern Passage have been obtained for the following periods and dates: 3 months in 1913, 4 months in 1919, and 12 months in 1930 and 1931.

In recent years comprehensive current surveys of a number of the important waterways of the United States have been made, and the field work of such a survey of Narragansett Bay was executed by J. C. Sammons in 1930. One hundred and twenty current stations in the bay and connecting waterways were occupied, each for a period of 1 or more days. At each station, currents were observed at the surface and at several subsurface depths.

In 1931, G. E. Boothe, supplementing the work of the preceding year, obtained 2½ days of current observations at each of four current stations—two in the Seekonk River and two in the Sakonnet River.

METHODS OF OBSERVING

In general, the process of observing currents consists of measuring usually at fixed intervals of time such as hourly or half-hourly, the velocity of the current; noting the direction the current is flowing at each measurement of velocity; and recording the direction, the velocity and the time at which each measurement is made. Various means of taking such observations have been employed. The two devices most used in recent years by this Bureau and which were employed in 1930 and 1931 in the Narragansett Bay work, are the *current pole* and the *Price current meter.*

The *current pole* is a wooden pole so weighted with lead that it will submerge for most of its length and assume a vertical position when placed in the water. The pole is attached to a line and allowed to drift with the current while an observation is being made. The line, known as a current line, is marked in principal and secondary divisions, each secondary division being one-tenth of a principal division. The length of each principal division bears the same ratio to a nautical mile that the time the pole is allowed to drift bears to an hour. By this means the velocity in knots (nautical miles per hour) and tenths is read directly from the current line. The direction toward which the pole drifts is observed usually by compass and pelorus on the vessel, and when practicable is verified by sextant angles between the pole and fixed objects on shore. The velocity obtained by this method is considered the velocity at a depth equal to one-half the length of the submerged portion of the pole. The standard current pole now in use is 15 feet long and is so weighted as to float with 1 foot above the water surface. Shorter poles are sometimes used when the water is very shallow. The 15-foot pole was used for all the observations secured on the Brenton Reef Lightship.

The observations made by Blake, Marindin, and Pillsbury appear to have been taken by a method similar to the present current-pole method. In place of the pole, Marindin used two cans connected by a wire, one can being submerged and the other allowed to float on the surface. The submerged can was set at any desired depth by changing the length of the connecting wire. A somewhat similar arrangement was probably used by Blake, for his records mention a "surface log" and an "under log." The details of Pillsbury's apparatus are not definitely known but it appears likely that it was similar to that used by Marindin.

The *Price current meter* is used for taking subsurface observations of velocity only. The working parts of this meter consist of a set of conical metal cups arranged on the periphery of a wheel which is mounted on a vertical shaft. The upper end of this shaft actuates a mechanism which makes and breaks an electric circuit, producing clicks in a telephone receiver connected in the circuit. When the meter is lowered into the water, the current striking the metal cups causes the wheel to rotate, the speed of rotation and consequently the frequency of the clicks in the telephone receiver depending upon the velocity of the current. To obtain the velocity of the current, therefore, it is only necessary to count the clicks in the receiver for a specified length of time and from a previously prepared rating table take the velocity corresponding to the observed number of clicks. Since the Price current meter does not give the direction of the current, it is generally used by this Bureau in conjunction with the current pole, the general direction of the subsurface current being inferred from the pole observations.

METHODS OF REDUCING THE OBSERVATIONS

Under this heading are outlined briefly several methods of current reduction, together with mention of the various series of current observations in Narragansett Bay to which each method was applied.

The method described below, used in reducing the 1913 and the 1919 series of observations at Brenton Reef Lightship, is typical of the procedure usually followed in reducing current observations for localities where the tidal current is of the reversing type.

The records of the field party were first carefully verified to see that the observed directions had been accurately reduced to true azimuths by applying to the pelorus reading the proper corrections for the ship's head, the deviation of the ship's compass and the magnetic variation. The observed velocities were next plotted on cross-section paper, the times of observations being taken as abscissae and the velocities plotted as ordinates, the flood velocities above and the ebb velocities below the horizontal line representing zero velocity. Smooth curves were drawn following the general trend of the plotted velocities and from these curves the times of slack waters and the times and velocities of the strengths of flood and ebb were taken. These times and velocities, together with the true direction of each strength of flood and ebb were tabulated on forms prepared for the purpose. The times of slack water and of strength of current were then compared with the times of high and low water at Newport and average time differences computed for each of the four phases of current—namely, slack before flood, strength of flood, slack before ebb, and strength of ebb. Average true directions of flood and ebb were obtained for each series of observations and the average velocities of flood strength and ebb strength were computed.

Prior to 1930, current information for Narragansett Bay proper was very meager and the extent of the irregularity existing in the current movement there was not known. When the work of reducing the records from the 1930 survey began, an attempt was made to follow the general scheme of reduction outlined above. As the work progressed, however, it became increasingly apparent that the smoothing of the velocity curves into the usual flood and ebb portions, with definite times of strength and slack, could not be accomplished without doing violence to the observational values. The current at many stations would not fit the conventional form and, consequently, it became necessary to devise special methods of reducing the observations and presenting the results. The most noticeable irregularity in the current as graphically represented appeared in the form of a depression in the approximate center of the flood portion of the current curve when plotted as described above. This depression frequently reached the line of zero velocity or extended below it, in the latter case producing the anomaly of an ebb current and two extra slack waters near the time when the strength of the flood current would be expected to occur.

A tabulation of the average velocities and directions of the current for each hour, or half hour, of the tidal cycle appeared to be a satisfactory means of showing the true nature of the current movement as observed at the various stations. To accomplish this purpose, the half-hourly observations of velocity and direction were tabulated in 25 groups, one group for each half hour from zero to 12 hours after the time of high water at Newport. Each observed value was assigned to the group to which it most nearly corresponded in time. A separate tabulation was made for each depth observed at each station.

For each half-hourly group an average velocity and an average direction were computed for the surface current as observed by pole, and an average velocity was obtained for each meter depth. To reduce the velocities thus obtained to approximate mean values there was applied to each a factor representing the ratio of the mean range of the tide at Newport to the range at Newport for the period covered by the current observations. In addition, the nontidal current near the surface for each series of observations was obtained by averaging algebraically the 25 half-hourly averages of velocity obtained from the pole observations, considering the flood as positive and the ebb as negative. The observations of Blake, Marindin, and Pillsbury, as well as the recent observations by Sammons and Boothe, were reduced by the half-hourly method.

The times of 58 slack waters observed by Marindin in the Seekonk River, off India Point, were referred directly to the times of high water at Newport and average time differences obtained for the slacks before flood and the slacks before ebb.

The 1930–31 series of hourly observations taken at Brenton Reef Lightship was reduced by the following method. The individual observed velocities were first resolved into their north and east components. The north and east components were each tabulated in 13 groups, one group for each hour from 0 to 12 hours after high water at Newport. The average velocity and direction for each hour were obtained from this tabulation. From a plotting of the average hourly values on cross-section paper, the times of slack and strength and the velocities of flood and ebb strengths were obtained. The direction and velocity of the nontidal current for the series were determined by averaging the resolved hourly velocities for all times of the tide, a process which eliminates the tidal current since the mean value of the resolved tidal current is zero.

When series of current observations cover a number of months, the more important velocity variations average out in the reductions and the direct averages of velocity are usually taken as mean values The two series at Brenton Reef Lightship were treated in this way, no correction being applied to the observed velocities.

The process of harmonic analysis used for the reduction of the hourly heights of the tide is also applicable to the reduction of the hourly velocities of the current. An 87-day series of observations at Brenton Reef Lightship was analyzed harmonically, the north and east components of the observed velocities being tabulated and analyzed separately. Special harmonic analyses for a number of stations were made for the purpose of developing the harmonics of the principal tidal constituent M_2 in connection with the study of the peculiar current conditions observed in the bay. These are discussed on page 24. For a detailed explanation of the application of the harmonic analysis to the reduction of tides and tidal currents, reference is made to United States Coast and Geodetic Survey Special Publication No. 98, A Manual of the Harmonic Analysis and Prediction of Tides.

PRESENTATION OF THE RESULTS

DESIGNATION AND LOCATION OF STATIONS

Each current station in Narragansett Bay has been given a designation which consists generally of two parts; first, a letter or letters signifying the party or the chief of the party that occupied the station, and, second, a number or letter which is wherever possible the designation originally assigned to the station. The letters forming the first part of the designation and the party signified in each case are as follows:

B=G. S. Blake, 1844.
M=H. L. Marindin, 1874.
P=J. E. Pillsbury, 1889.
LS=Crew of Brenton Reef Lightship, 1913, 1919, 1930–31.
S=J. C. Sammons, 1930.
Bo=G. E. Boothe, 1931.

The locations of the stations occupied are indicated in figures 8 and 9 by red circles together with the corresponding station designations. The stations in Providence Harbor are included in figure 9, all other stations being represented in figure 8.

EXPLANATION OF THE TABULAR DATA

For reasons stated in the description of the methods of reduction, the usual plan of tabulating the results of current observations by giving the times of slacks and strengths of the current, together with the mean velocities of the strengths and the directions of flood and ebb, was not thought desirable for most of the stations in the Narragansett Bay area. That the tabular data might show as nearly as practicable the true nature of the current movement as observed at the various stations, it was decided to tabulate the velocities and directions, obtained as described on page 19, for each hour from zero to 12 hours after high water at Newport. By this method of presentation, data are given for 13 points in the tidal cycle instead of the usual 4 points, thus displaying the true nature of the current move-

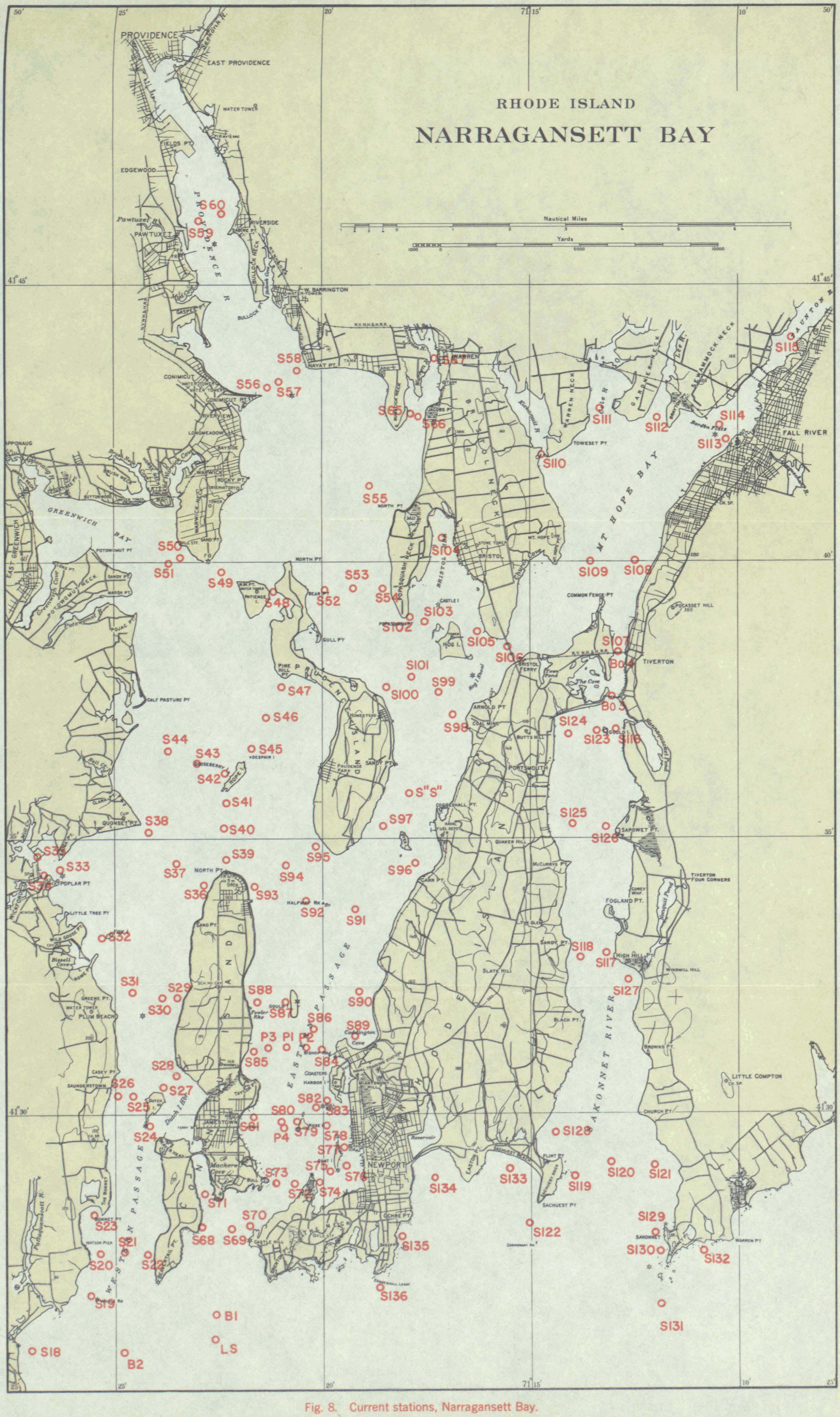

Fig. 8. Current stations, Narragansett Bay.

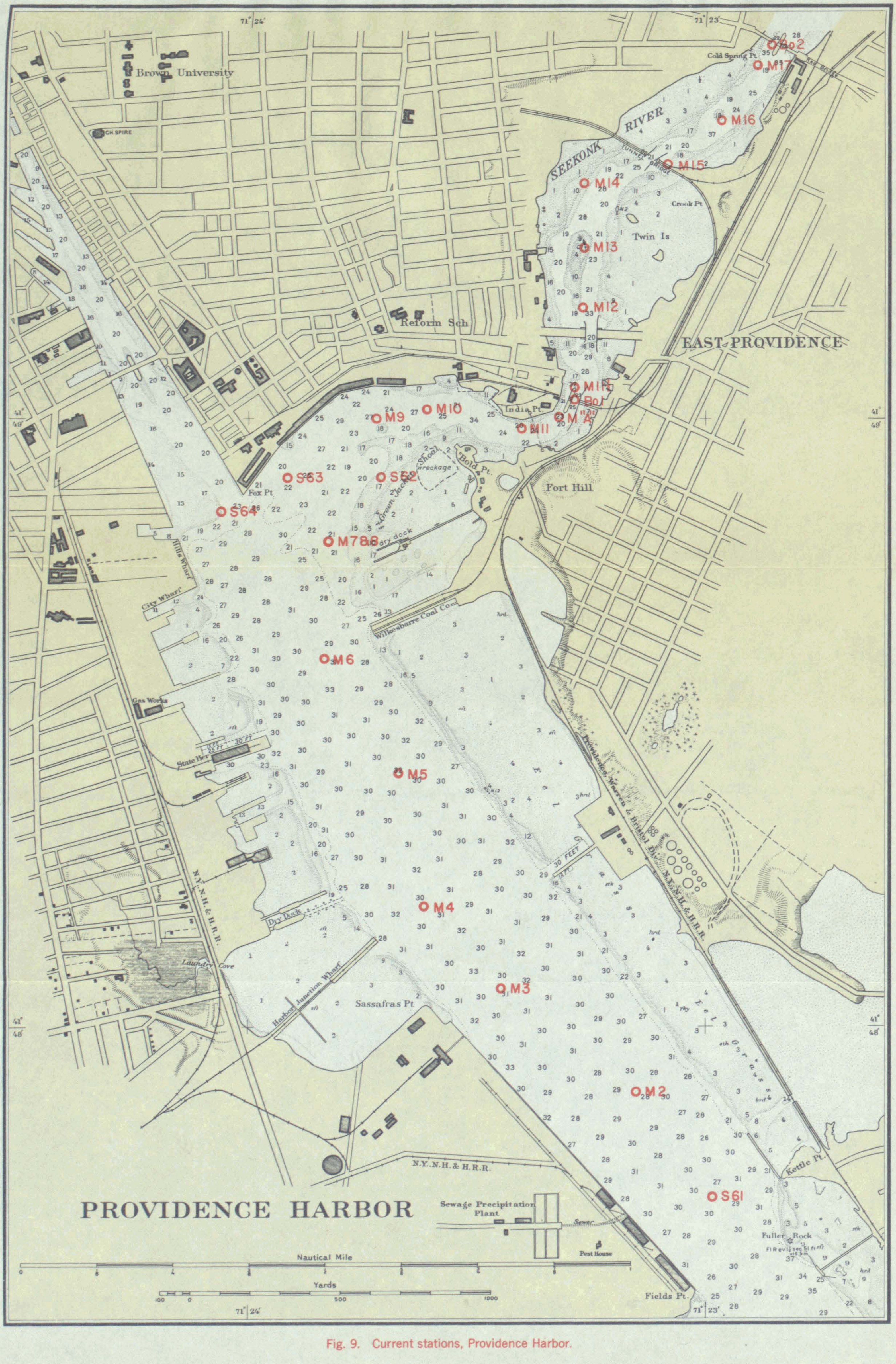

Fig. 9. Current stations, Providence Harbor.

ment and avoiding the necessity for forcing the irregularly shaped current curves characteristic of this area into the prescribed cosine form.

In table 1 the hourly velocities and directions derived from the observations at each station are given. The observations of each party are placed in a separate group, and the groups are arranged in chronological order, each under a subhead which indicates the observing party and the year the observations were taken. The designation of each station, a brief descriptive statement of its location, its latitude and longitude to the nearest tenth of a minute, and the month and day of the beginning and of the end of the series of observations are given. The total period in days covered by the observations, the methods used and the depths at which observations were made are also given. The depth tabulated for the observations taken by pole is in each case one-half the length of the submerged portion of the pole. The true directions are reckoned from true north (0°), through east (90°), south (180°), and west (270°). In most cases directions were observed only by pole, and consequently no directions are given for the meter depths. The velocities are expressed in knots (nautical miles per hour), and decimals. The average velocities and general directions of the nontidal currents for the various series of observations, shown in the last column of the table, apply to the surface currents as observed by pole.

Table 2 contains the times of slack water and the times, directions, and velocities of the strengths of flood and ebb, derived from the three series of observations at Brenton Reef Lightship as explained on pages 19 and 20. Average times of slack before flood and slack before ebb obtained from the slack water observations at station M "A", off India Point, in the Seekonk River are included in this table. The average velocities of the flood and ebb strengths at station P 4 in Eastern Passage are also included. It appears that these velocities constitute the only information recorded for this station. The time relations in table 2 are expressed in hours and decimals. The directions are true and the velocities are in knots.

Harmonic constants from 87 days of current observations at Brenton Reef Lightship are given in table 3. Constants for the north and east components were derived separately as explained on page 20.

TYPICAL OBSERVED CURRENT CURVES

In figures 10 to 13, inclusive, are shown curves plotted from current observations at a number of stations in various parts of Narragansett Bay. These curves serve as a rough index to the general character of the current movement and the extent of the irregularity in various parts of the area. They indicate that the effect of the disturbing influences that tend to distort the current curve from the cosine form is relatively small near the entrance to the Eastern and Western Passages and that it reaches a maximum at the bridges in the Sakonnet River. It will be noted that the two stations in Western Passage (fig. 10) were observed simultaneously as were also the two in Eastern Passage (fig. 11). The four curves shown in figure 13 were plotted from observations made simultaneously at the four stations, two in the Seekonk River and two in the Sakonnet River. The various curves show that the irregularity differs not only from place to place but also for different tidal cycles at the same place.

NATURE OF THE OBSERVED IRREGULARITY

A preliminary examination of the results of current observations in Narragansett Bay led to the belief that the peculiarity existing in that area is due to the effects of certain tidal constituents which as

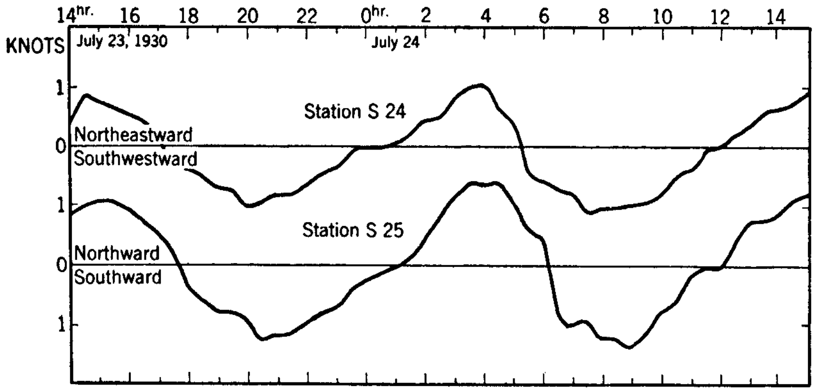

FIGURE 10.—Current velocities observed in Western Passage.

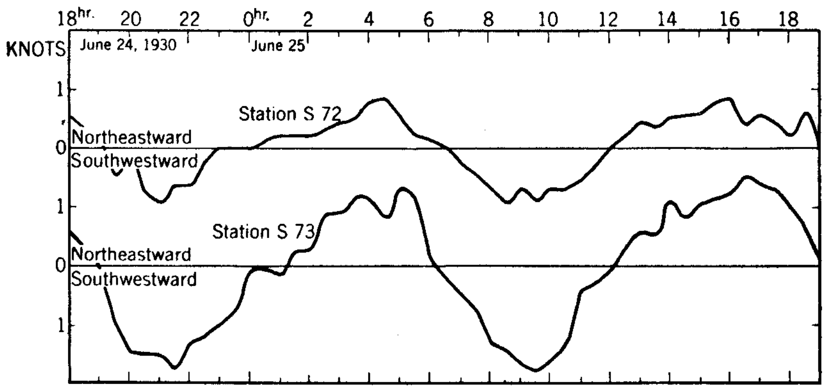

FIGURE 11.—Current velocities observed in Eastern Passage.

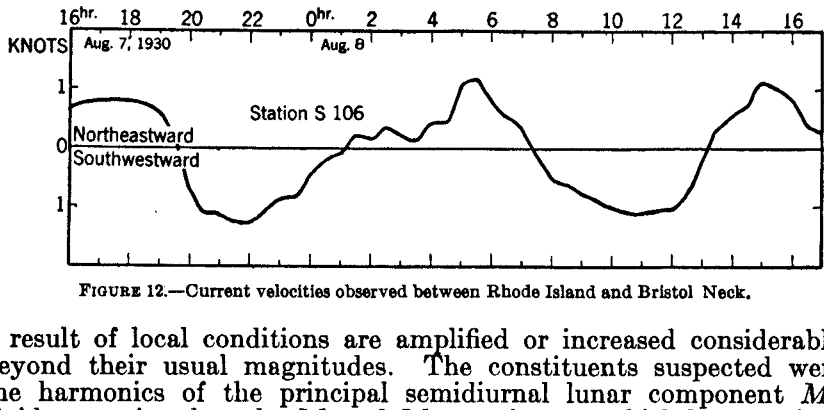

FIGURE 12.—Current velocities observed between Rhode Island and Bristol Neck.

a result of local conditions are amplified or increased considerably beyond their usual magnitudes. The constituents suspected were the harmonics of the principal semidiurnal lunar component M_2. Evidence pointed to the M_4 and M_6 constituents which have periods one-half and one-third, respectively, of the 12.42-hour period of M_2. The nature of this evidence is briefly outlined below.

It is a recognized fact that bodies of water such as lakes and bays have natural periods of oscillation, depending upon their dimensions and shapes, and that impulses impressed upon them having approximately these same periods build up large oscillations in accordance

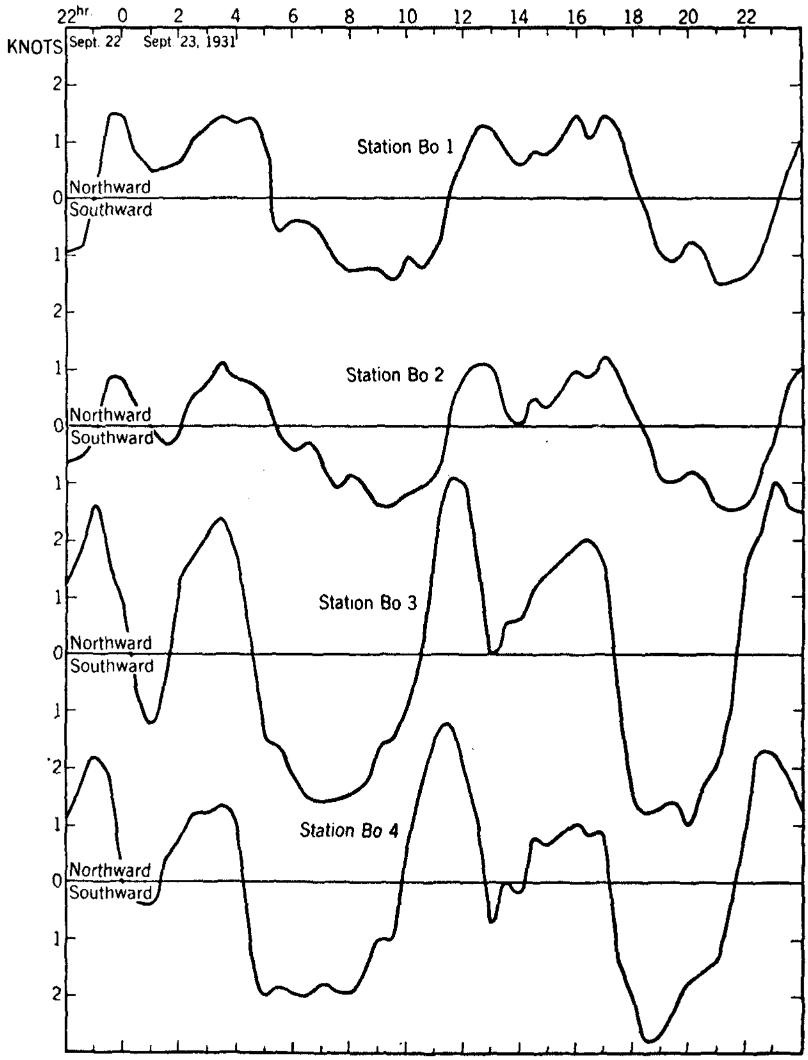

FIGURE 13.—Current velocities observed in Seekonk and Sakonnet Rivers.

with the well-known principle of resonance. Each such oscillation has a vertical or tide constituent and a horizontal or current constituent.

The determination of the exact natural period of oscillation of an irregularly formed body of water such as Narragansett Bay is a very complicated problem but a rough approximation to the period may be obtained mathematically when the dimensions are known by means of the following relation, which applies to a long rectangular bay of uniform depth:

$$\text{Period}=\frac{4\,L}{\sqrt{gh}}$$

Where L is the length of the bay, g the acceleration of gravity, and h the average depth of water in the bay.

The length of Narragansett Bay is roughly 24 nautical miles, or 145,920 feet. The approximate average depth at half tide level, as determined by averaging soundings in selected rectangular areas drawn on a chart of the bay, is 25 feet. Taking the acceleration of gravity as 32.2 feet per second and substituting in the above formula, we have:

$$\text{Period}=\frac{4\times145{,}920}{\sqrt{32.2\times25}}=20{,}574\text{ seconds}=5.72\text{ hours}$$

This roughly obtained value falls between the M_4 period of 6.21 hours and the M_6 period of 4.14 hours. It might be expected, therefore, that waves of both these periods, which exist in the oceanic tide sweeping into the bay, and each of which approximates in period the natural period of the bay, would build up relatively large oscillations.

In order to determine the magnitudes of the principal lunar constituents at a number of selected stations in different parts of Narragansett Bay, the mean half hourly velocities as determined from the observations at these stations were reduced by harmonic analysis. The process used was a modification of that described in Coast and Geodetic Survey Special Publication No. 98, A Manual of the Harmonic Analysis and Prediction of Tides. The mean half hourly velocities as referred to the times of high water at Newport, which had already been obtained from observations, were plotted on cross-section paper and a curve drawn through the plotted points. That portion of the curve representing a complete semidiurnal tidal cycle of 12.42 hours beginning with the time of high water at Newport was divided into 24 equal parts. The velocities at the points of division beginning with the time of high water at Newport as the initial point, were entered as the 24 hourly means in form 194 illustrated on page 150 of Special Publication No. 98. Then, doubling all subscripts in the form to allow for the fact that the means were actually half-hourly rather than hourly values, the epoch (ζ') and the amplitude (R') of each constituent were computed. The epoch thus obtained is the interval in degrees between the time of high water at Newport and the time of flood strength of the constituent and may be readily converted into solar hours by taking into account the period of the constituent. The amplitude represents the velocity of the constituent at the strength of flood or ebb.

The results obtained from the analysis for the M_2, M_4, and M_6 constituents for station Bo 1 are shown diagramatically in figure 14. The velocity of the M_8 constituent was so small as to be of no practical importance. The curves marked M_2, M_4, and M_6 show the velocity and direction of the M_2, M_4, and M_6 currents, respectively, for the tidal cycle. Below these curves is shown a curve obtained by adding the three constituent curves and at the bottom of the figure is the mean observed current curve from which the constituent curves were

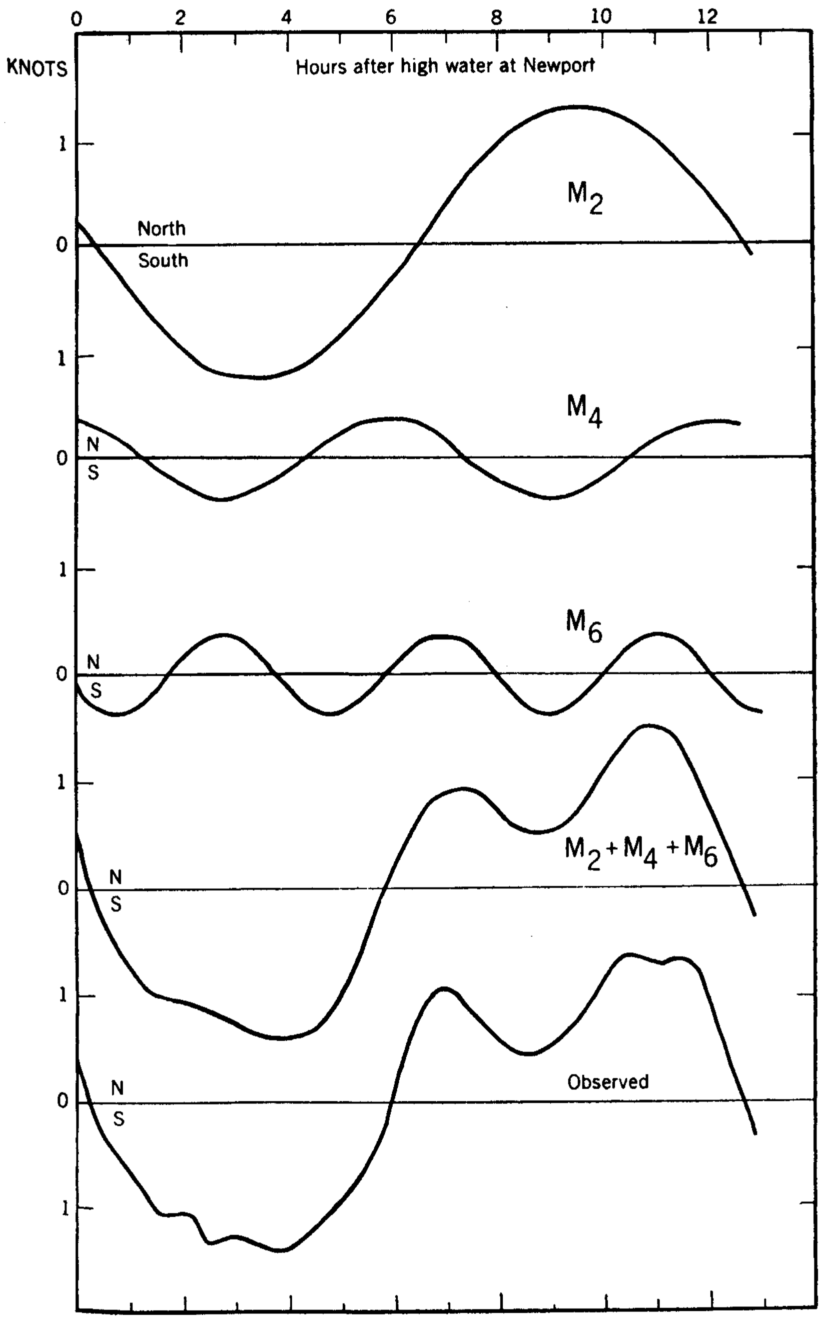

FIGURE 14.—Combination of M_2, M_4, and M_6 currents, Station Bo 1.

derived. The striking similarity between the two last-mentioned curves, indicates clearly that the observed current movement is definitely a combination of the three movements represented by the three constituent curves, and that any other constituent movements must be relatively small and unimportant. It is clear also that the marked depression in the flood portion of the curve which is characteristic of the current throughout most of the Narragansett Bay area is due to the combination of an M_4 ebb and an M_6 ebb which occur at this time. The general existence of this particular peculiarity indicates that the three constituent movements have approximately the same time relation to each other throughout the area.

The analysis described above was made for 36 stations in different parts of Narragansett Bay and the results are given in table 4 and are also presented graphically in figures 15 and 16. In table 4, the times and velocities refer to the flood strengths of the respective constituents, the times being reckoned from the time of high water at Newport. It should be noted that the time given in each case is that of the first flood strength after Newport high water. In the case of the M_6 constituent, successive flood strengths occur at intervals of 4.14 hours and for M_4 the interval is 6.21 hours.

Figure 15 shows the times of flood strength of each of the three current constituents at 36 stations. The values are plotted from the data contained in table 4, the times after high water at Newport being taken as ordinates and the latitudes of the stations as abscissae. The number of the station corresponding to each plotted point is given. The lines connecting the plotted points serve to identify the portions of the waterway represented by the points thus connected. The plottings show that each of the three movements is approximately simultaneous in all parts of the area and that the time relations existing between the movements are approximately uniform in the various passages. Much of the roughness apparent in the plotted values doubtless results from accidental conditions or weather effects which are always relatively important where the observational series are short and the current velocities small. It is evident that the M_2 current and to a lesser degree the M_4 and M_6 currents occur somewhat earlier at the Sakonnet River bridges than in other parts of the area.

Figure 16 is similar to figure 15 except that velocities at strength instead of times are plotted as ordinates. The figure indicates the relative magnitudes of the three constituent velocities in the area as a whole, in the various portions of the area, and at the individual stations.

To bring out more clearly the nature of the current movement in Narragansett Bay and particularly the relation of the constituent currents to the constituent tides, a few brief statements relative to wave movements are given below.

Two general types of tide waves are recognized, the progressive wave and the stationary wave. A progressive wave is one that travels or progresses from one part of a body of water to another. Such waves may be produced by throwing a pebble into a still pond. A stationary wave is one that oscillates about an axis, high water occurring over the whole area on one side of the axis at the same instant that low water occurs over the area on the other side of the axis. A stationary wave may be set up in a rectangular tank partly

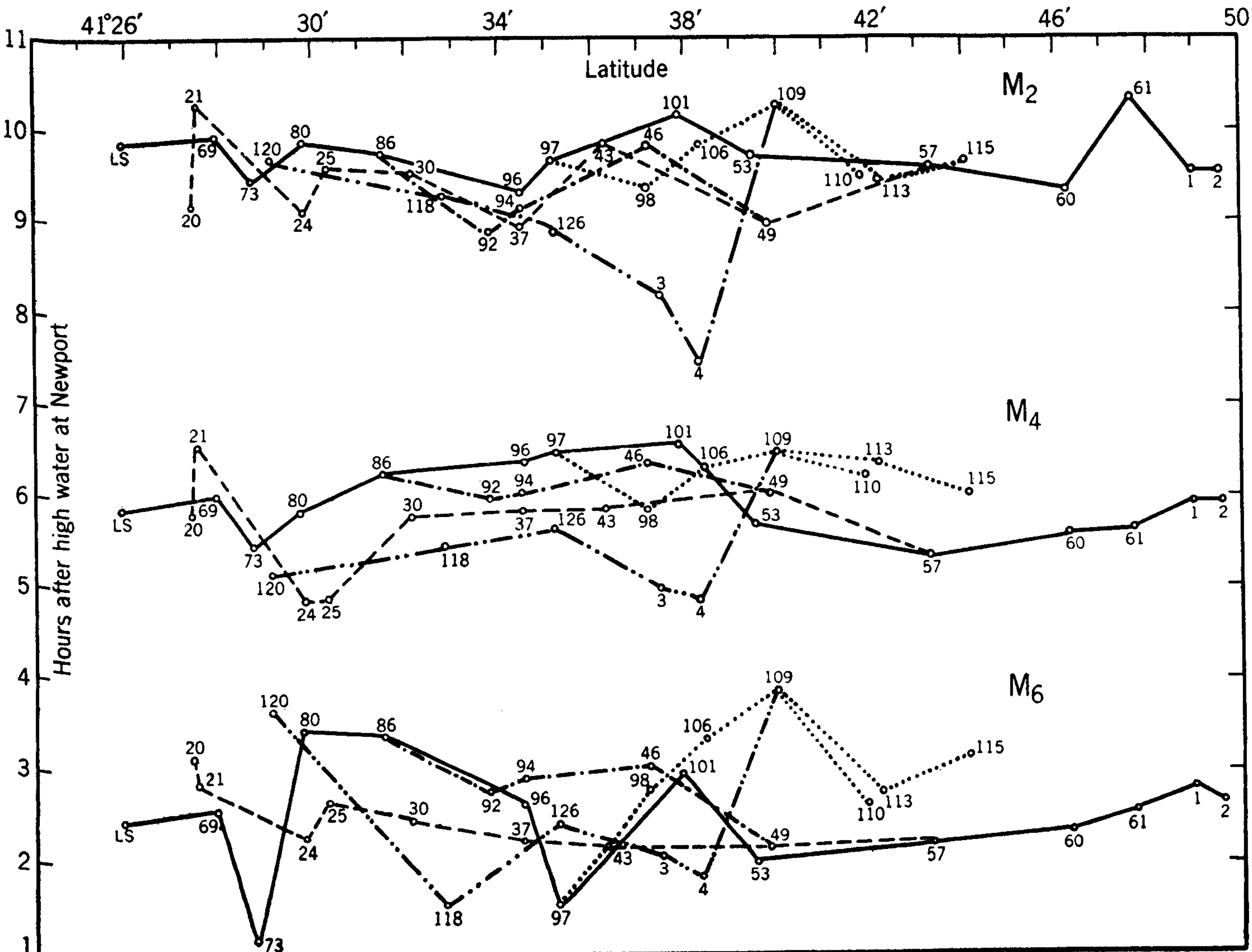

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FIGURE 15.—Times of flood strength of M_2, M_4, and M_6 currents.

Stations 1 to 4 are by Boothe in 1931. All other stations except LS, which is the Brenton Reef Lightship, are by Sammons in 1930.

Eastern Passage, Providence and Seekonk Rivers.
Western Passage.
Gould Island to Warwick.
Eastern Passage to Taunton and Kickamuit Rivers.
Sakonnet River.

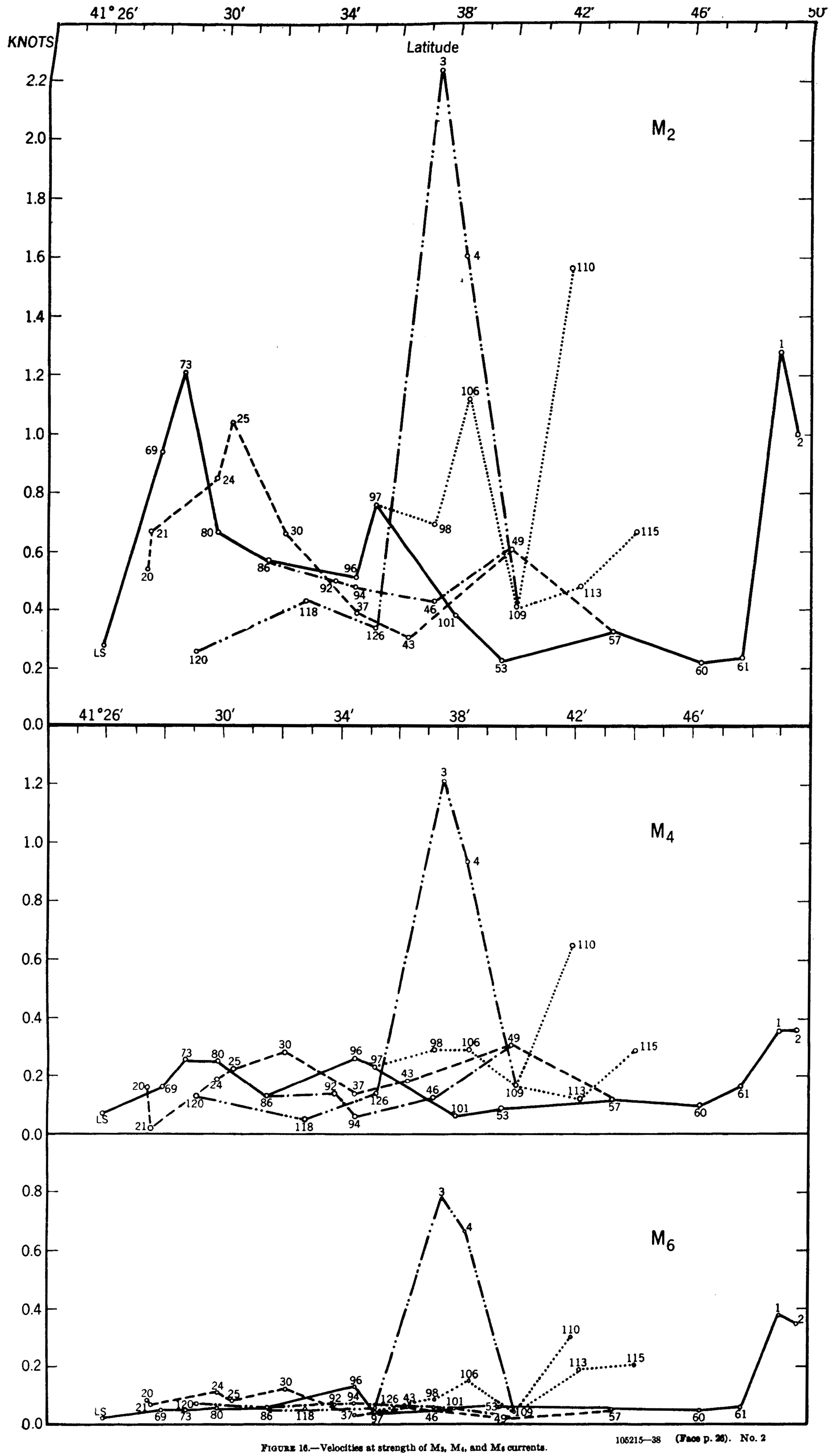

FIGURE 16.—Velocities at strength of M_2, M_4, and M_6 currents.

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Stations 1 to 4 are by Boothe in 1931. All other stations except LS, which is the Brenton Reef Lightship, are by Sammons in 1930.

Eastern Passage, Providence and Seekonk Rivers.
Western Passage.
Gould Island to Warwick.
Eastern Passage to Taunton and Kickamuit Rivers.
Sakonnet River.

filled with water by quickly raising and lowering one end of the tank. The wave oscillates about an axis or nodal line in the center of the tank, the water alternately rising and falling in each half of the tank.

In a progressive wave the strengths of current come at the times of high or low water and the slacks halfway between the high and low waters. In a stationary wave the slacks occur at the times of high and low water and the strengths midway between the high and low waters. A stationary wave oscillating in a bay open at one end usually has its axis or nodal line near the mouth of the bay, the movement in the bay corresponding to that in one-half of the above-mentioned tank. The formula stated on page 24 presupposes a movement of this sort.

That each of the three constituent movements is essentially a stationary wave movement is evidenced by the following facts:

1. In each case the movement is very nearly simultaneous throughout the area.

2. The amplitude of each constituent tide, as shown by tidal harmonic constants for Newport, Bristol, and Providence, increases from the mouth toward the head of the bay.

3. A comparison of the time relations between the M_2, M_4, and M_6 tides and the corresponding currents as determined by analyses of the tide and current observations shows that in each case the strengths of the current occur approximately midway between the high and low waters of the tide, which is the stationary wave relation.

A striking characteristic of the M_4 and M_6 movements is that although their effect in modifying the observed current curve is great, they are much less noticeable in the curve representing the heights of the tide. The explanation of this condition lies in the fact that the current velocities for a given amplitude of tide are increased in inverse ratio to their periods. In the case of the tank it is apparent that if the period of the oscillation were shortened to one-half its original value, the amplitude remaining the same, the velocity of the accompanying current would be doubled; if the period were reduced to one-third, the velocity would be multiplied by three, and so on. It follows that for the same rise and fall of the constituent tide the M_6 wave will produce a current velocity three times that produced by the M_2 wave and that the distorting effect of the M_6 curve upon the M_2 curve will be three times as great for the current as for the tide.

SUMMARIZING STATEMENTS

The current movement throughout Narragansett Bay is approximately simultaneous, the various phases of the current occurring at about the same time in all parts of the area with the exception of the Sakonnet River bridges. At these locations the current is from 1 to 1½ hours earlier than elsewhere in the area. A brief description of the movement in its relation to high water at Newport follows: At the time of high water at Newport the flood current has for the most part ceased to flow and the ebb current is about to begin. A condition approximating slack water prevails in most parts of the area. During the next 6 hours the current flows in an ebb direction gradually increasing to its strength or maximum velocity for the first 3 hours and then decreasing for 3 hours to another slack water. The flood current then begins, increasing for an hour or two to a maximum

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velocity, then decreasing to a lesser value or minimum flood velocity, which occurs about 8 or 9 hours after Newport high water, or approximately in the middle of the flood period. A second increase in the flood velocity then occurs and a second maximum velocity is reached which usually, but not in all cases, is greater than the first. This second maximum flood velocity occurs on the average about 11 hours after Newport high water. The velocity then decreases to another slack, completing the cycle of 12.42 hours.

The above description applies to the movement in general but variations occur at the different stations and during different cycles at the same station. As before stated, the various phases of the movement occur at the Sakonnet River bridges an hour or more before the times given above. At stations near the entrance the condition of minimum flood frequently does not occur but a distortion of the current curve is always present. Wind currents and weather conditions also may exert temporarily a profound influence in modifying the above outlined condition.

Tidal current velocities are subject to periodic variations corresponding to variations in the range of the tide. Due to these variations, the velocity at a given time may differ by 20 percent or more from a mean value, the velocities being greater than the mean at times of spring tides and perigean tides and less than the mean at times of neap tides and apogean tides. The velocities mentioned below are approximate mean velocities.

Over the greater part of Narragansett Bay the usual maximum flood or ebb velocity is from one-half knot to 1 knot, the first mentioned value applying approximately to the broad portions of the waterways, and the last mentioned to the more constricted sections. Velocities between 1 knot and 1½ knots occur at the bridges in the Seekonk River, a velocity of about 2 knots in the Narrows at the mouth of the Kickamuit River, and velocities of approximately 2¼ and 2¾ knots at the railway and highway bridges, respectively, in the Sakonnet River. In the Sakonnet River, from the highway bridge to its mouth, current velocities are small being generally less than one-half knot.

The currents at the Sakonnet River bridges are of considerable interest because of their large velocities, together with the fact that these velocities often change with great rapidity both in magnitude and in direction due to the relatively large effects of the M_4 and M_6 current constituents. Particular attention is invited to the fact that during the period between 7 hours and 9 hours after Newport high water, the individual observed velocities for a given time differ greatly from the mean values given in table 1. At some time during this period the northward velocity reaches its minimum value between two maximums. The exact time of this minimum flood appears to vary considerably from cycle to cycle. On the average it occurs very nearly 8 hours after Newport high water. Its velocity may be small or of considerable magnitude in either a northward or a southward direction. The large velocities observed appear to be limited to the draws of the bridges, at which points the width of the stream is greatly constricted. The movement is very much the same at the two bridges, except that the velocity is larger and the tendency for the current to flow southward in the middle of the flood period is more pronounced at the highway bridge than at the railway bridge.

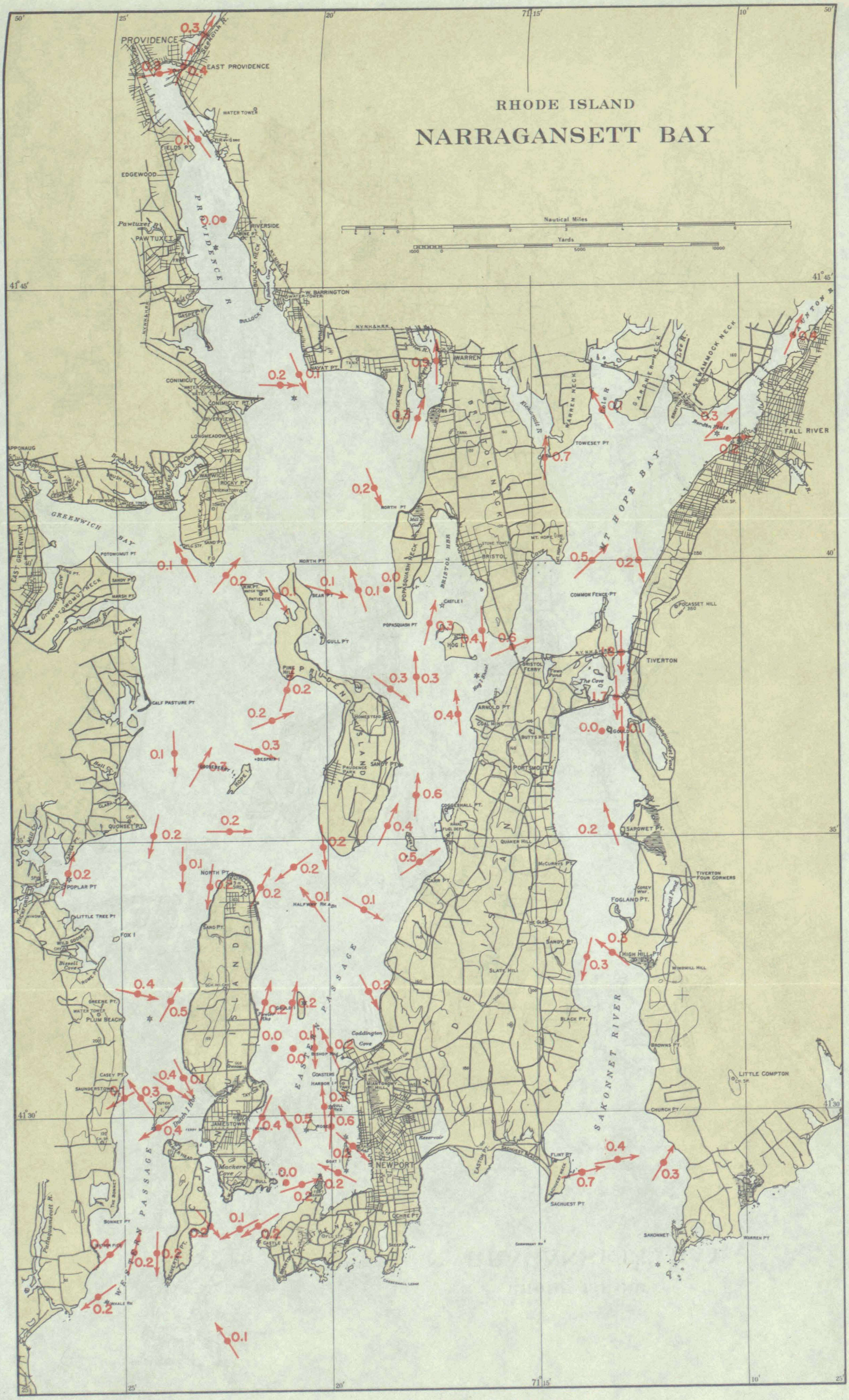

Fig. 17. Currents at time of high water at Newport.

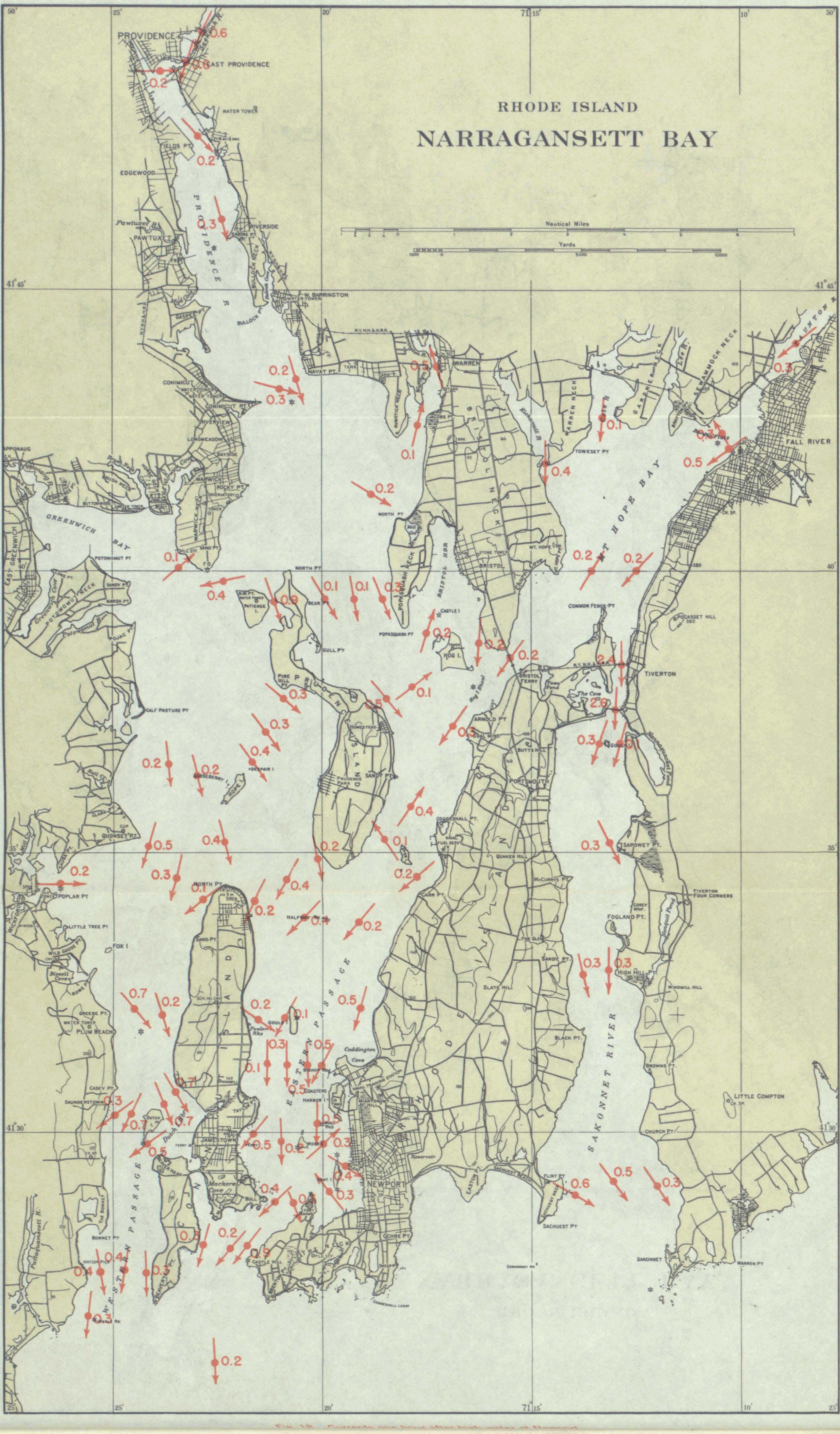

Fig. 18.—Currents one hour after high water at Newport

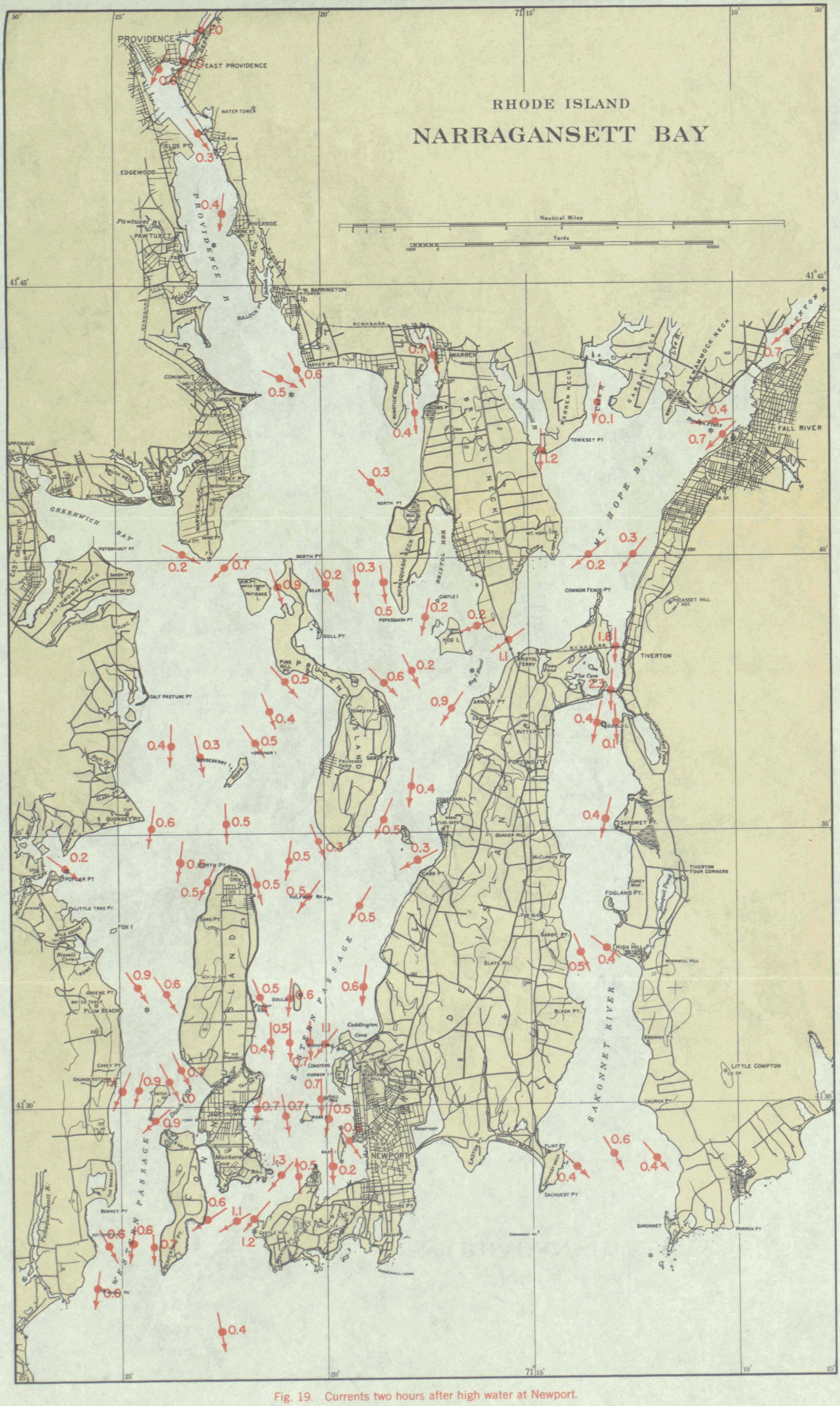

Fig. 19. Currents two hours after high water at Newport.

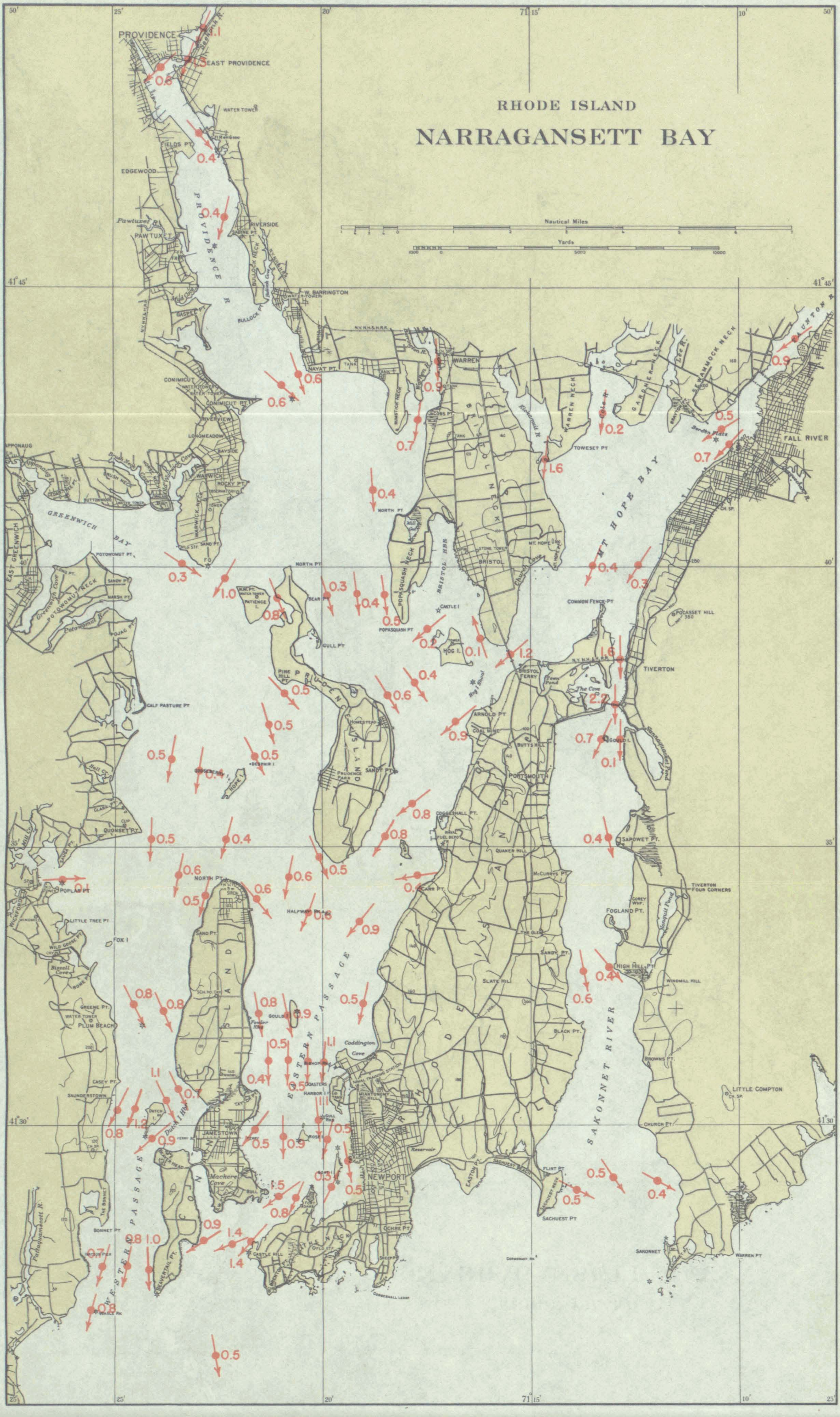

Fig. 20.—Currents three hours after high water at Newport

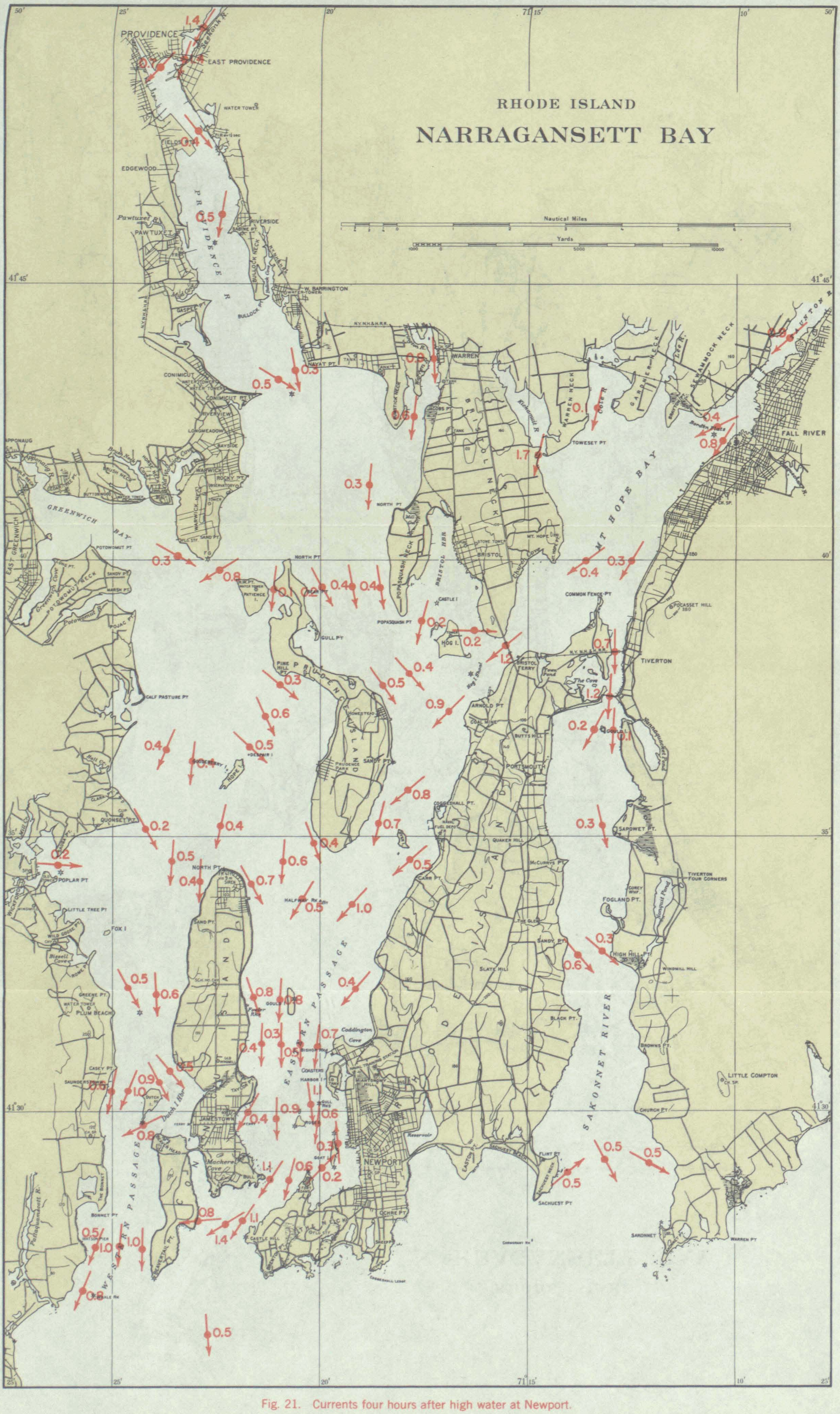

Fig. 21. Currents four hours after high water at Newport.

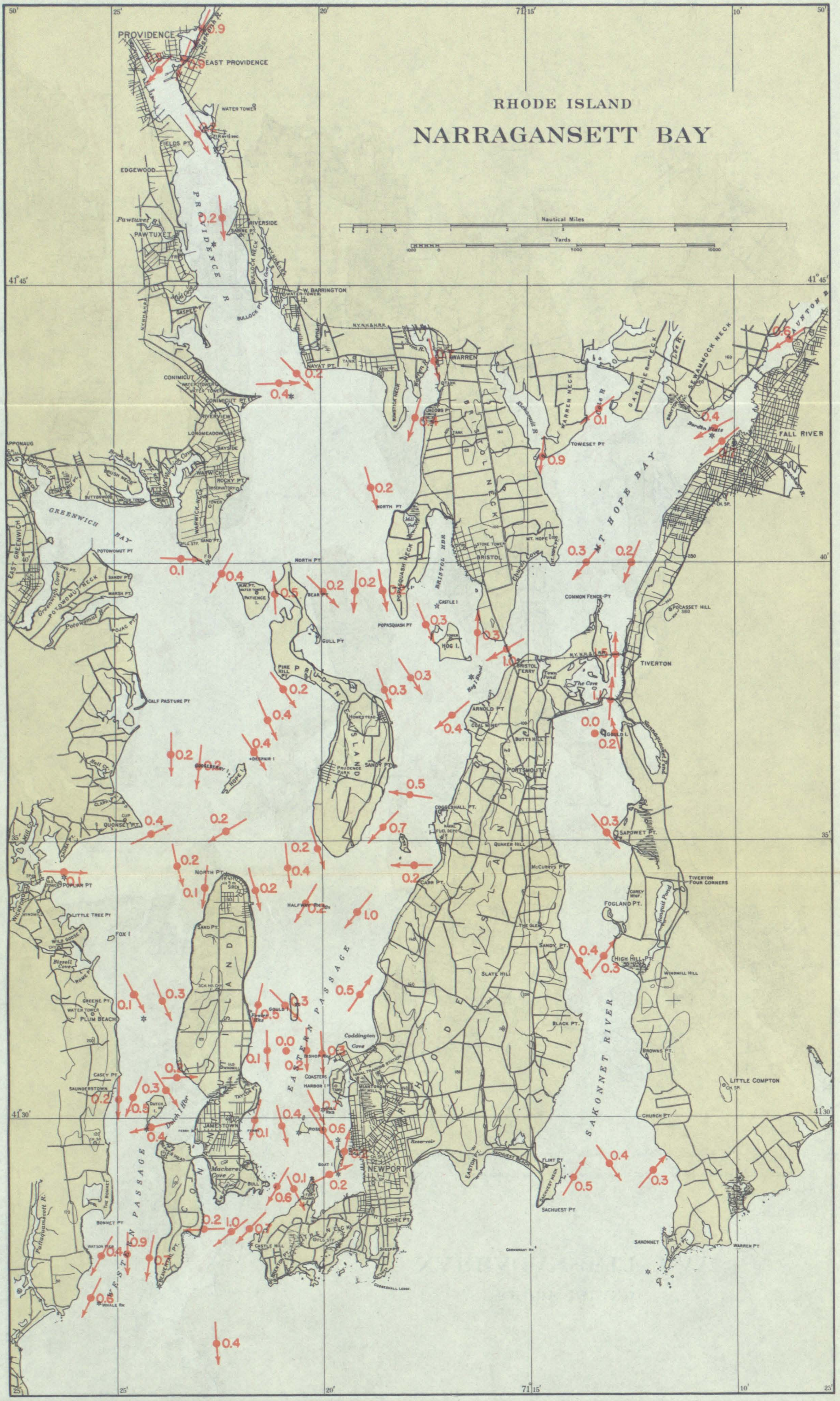

Fig. 22. Currents five hours after high water at Newport

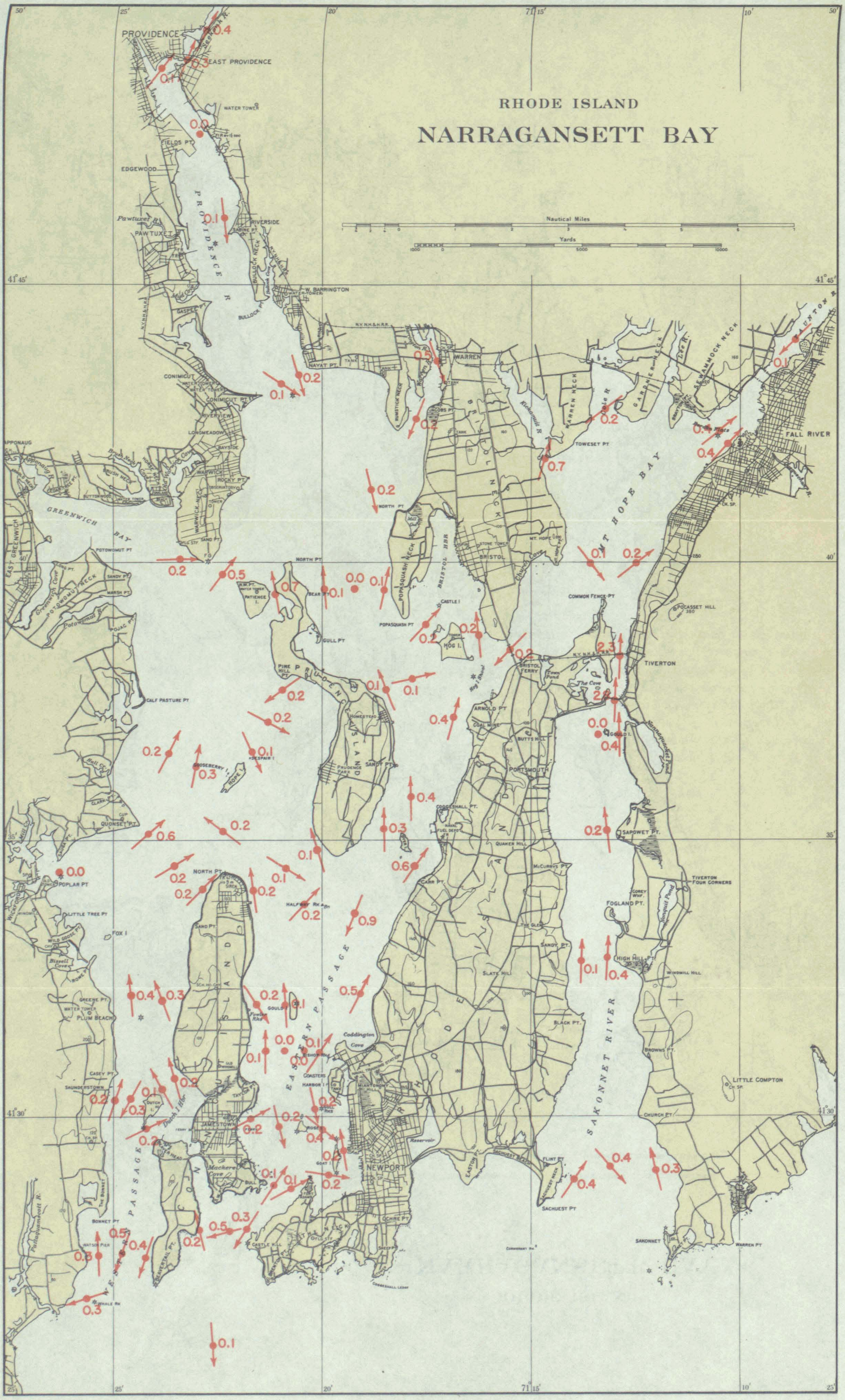

Fig. 23. Currents six hours after high water at Newport.

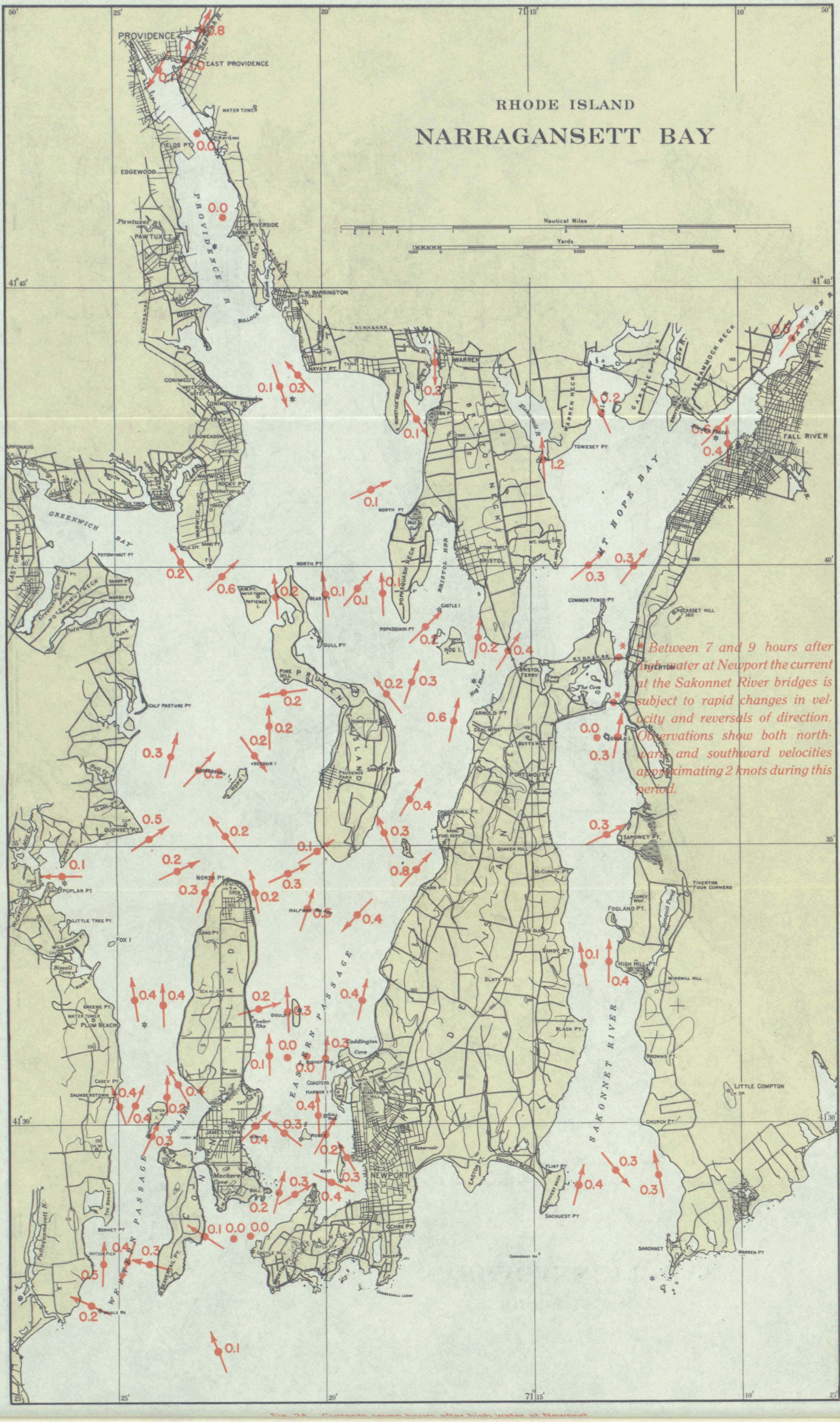

Fig. 24.—Currents seven hours after high water at Newport

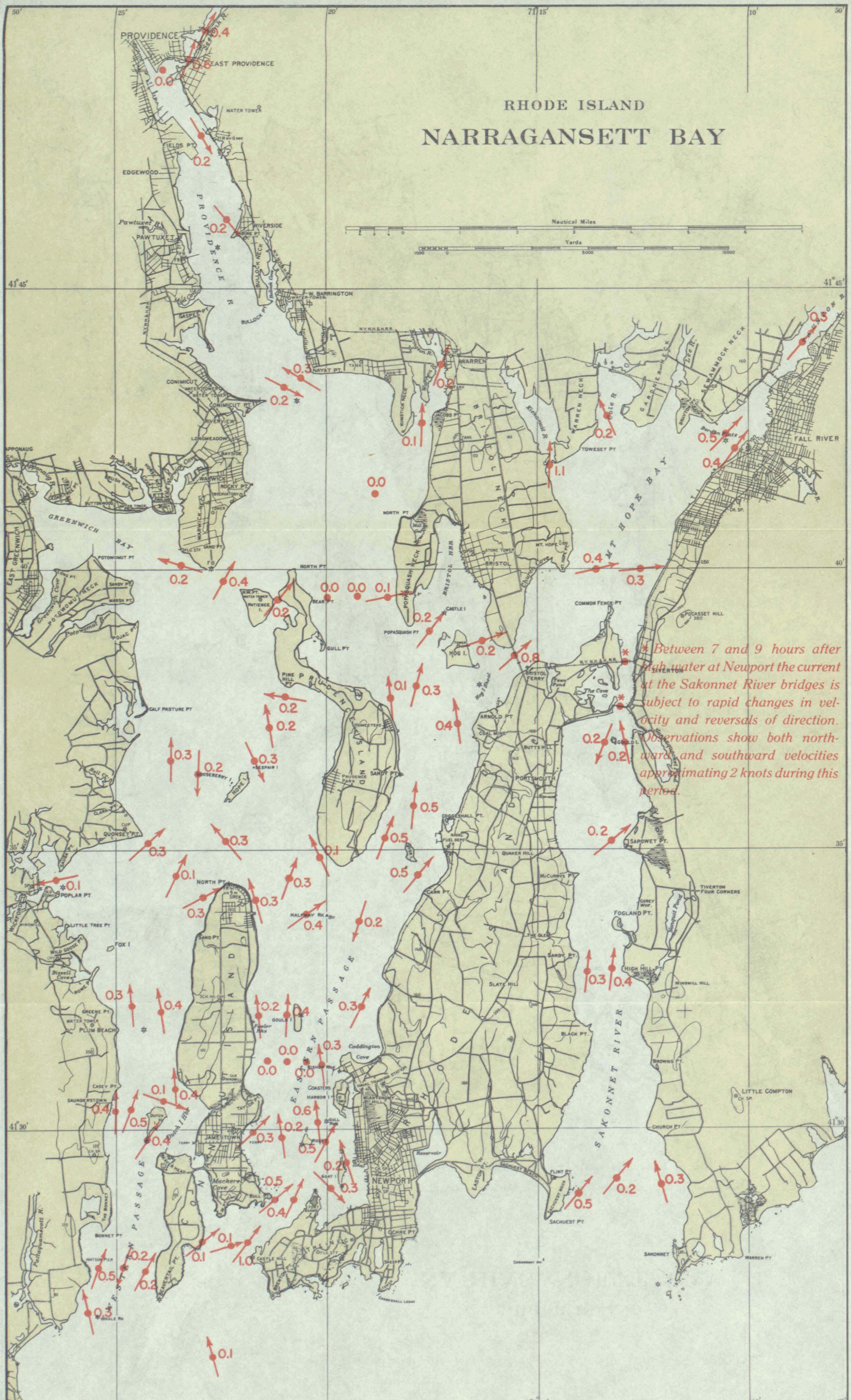

Fig. 25. Currents eight hours after high water at Newport.

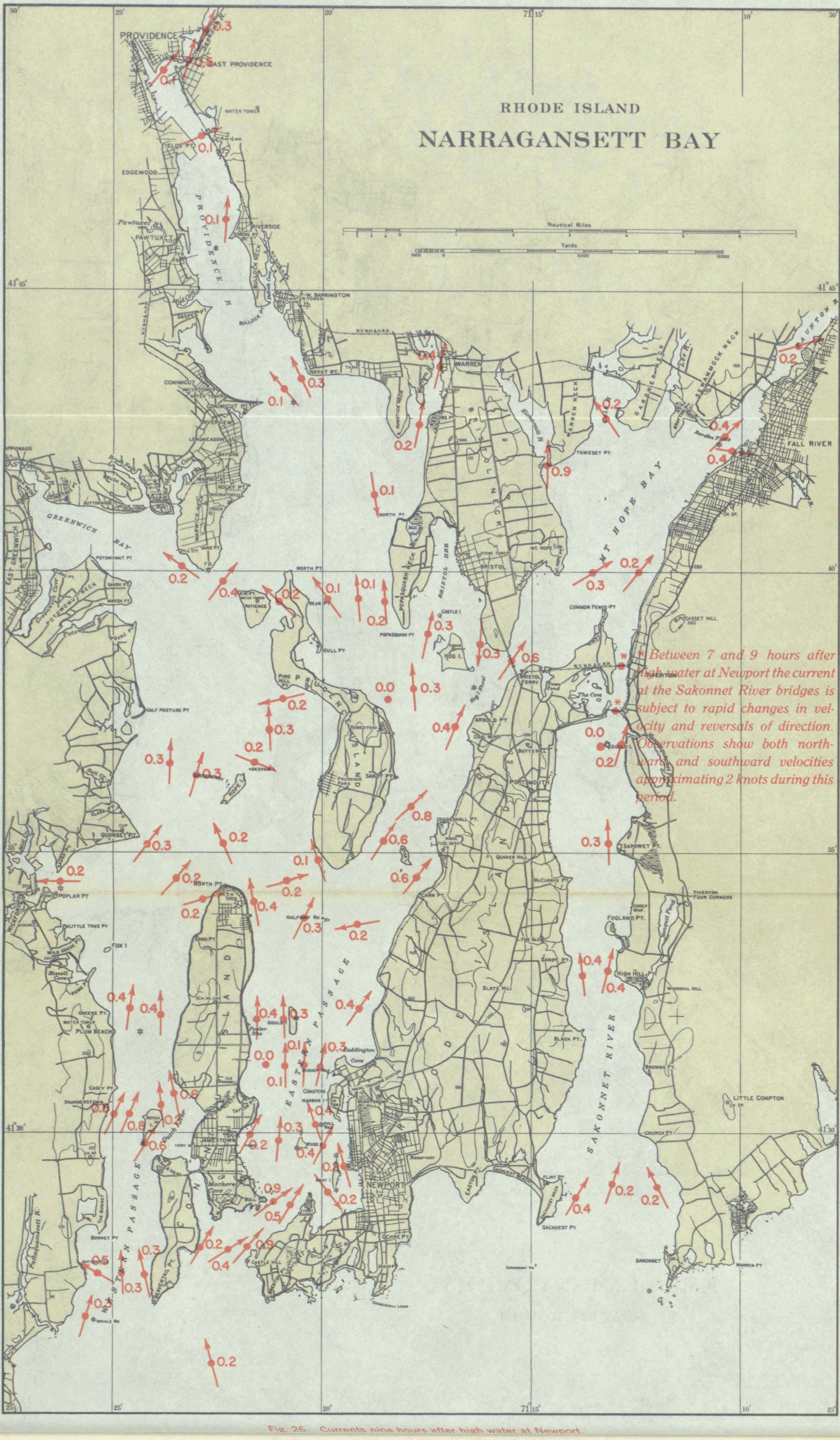

Fig. 26. Currents nine hours after high water at Newport.

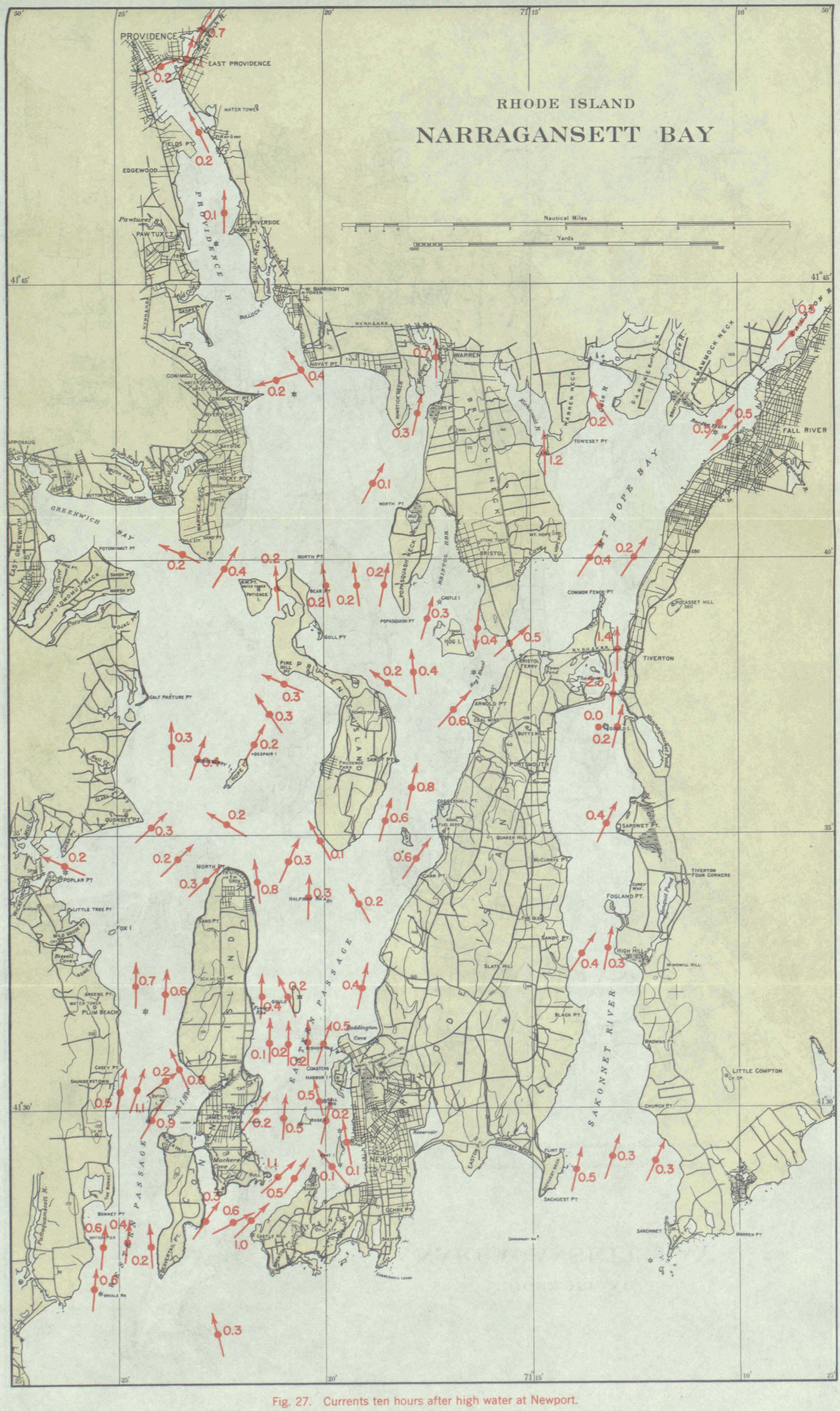

Fig. 27. Currents ten hours after high water at Newport.

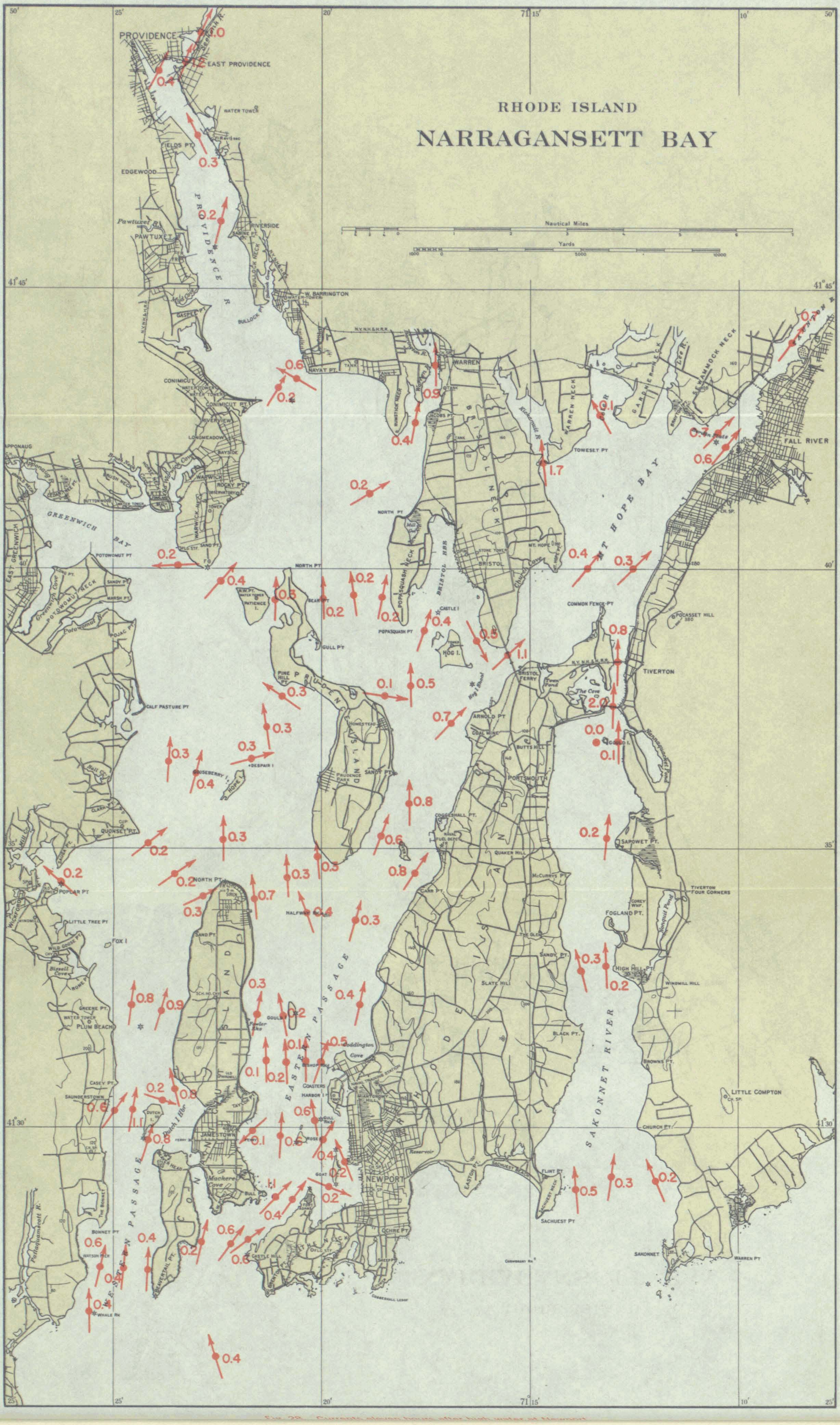

Fig. 28. Currents eleven hours after high water at Newport

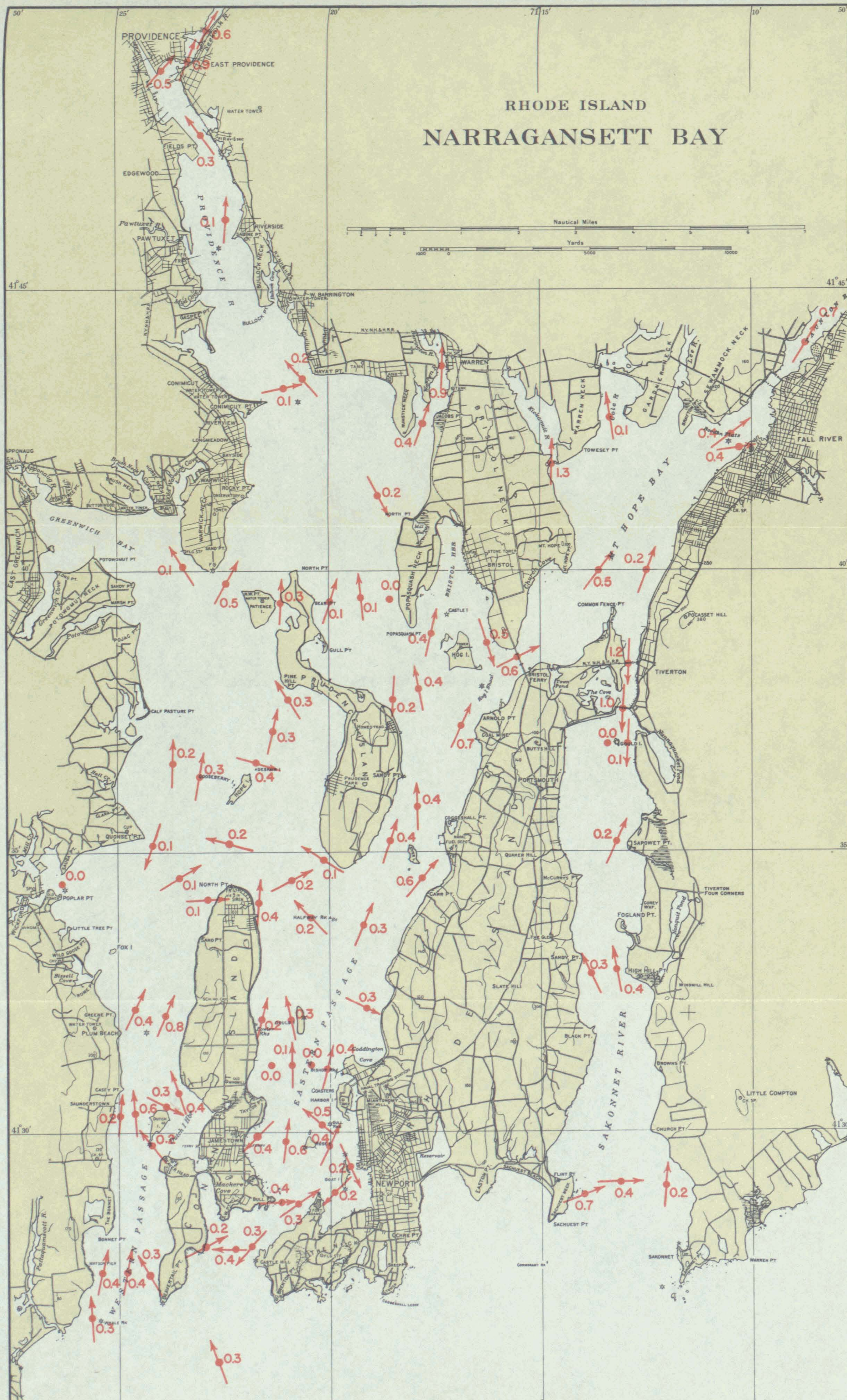

Fig. 29. Currents twelve hours after high water at Newport.

CURRENT CHARTS

The observed direction and velocity of the current at a number of locations in Narragansett Bay for each hour of the tide at Newport are represented in figures 17 to 29. The observations used in preparing the charts were taken within 14 feet of the surface. The locations at which the observations were taken are marked by circles. The observed directions of flow for the designated hour of the tide are represented by arrows drawn through the circles. The mean velocities for the designated hour are shown to the nearest tenth of a knot by numerals near the circles. At times of spring tides and perigean tides, the velocities normally are greater and at times of neap tides and apogean tides less than those given on the charts. The spring and perigean effects are practically equal in this locality, each producing a velocity increase above the mean of about 20 percent. When spring and perigean effects combine, the velocities of the tidal current are greatest. When neap and apogean effects combine, the velocities of the tidal current are least. Winds and other meteorological conditions at times modify both the direction and the velocity of the current.

TABLE 1.—*Current Data, Narragansett Bay*

[Referred to times of high water at Newport]

Station	Observer, location, and date	Observations: Period	Observations: Method	Observations: Depth	True directions and velocities: Units	Hours after high water: 0	1	2	3	4	5	6	7	8	9	10	11	12	Non-tidal current [1]
	G. S. BLAKE, 1844	*Days*		*Feet*															
B 1	1.2 miles S., 60° E. of Beavertail Light (41°26.3′ N., 71°22.6′ W.), Aug. 28, 30; Sept. 5, 6-7, 9-10.	2¾	Log	0	Degrees	346	207	180	182	177	180	173	45	16	18	7	0	354	S.
		2¾	do	0	Knots	0.04	0.18	0.44	0.53	0.50	0.26	0.12	0.10	0.15	0.27	0.32	0.38	0.18	0.06
		2¾	do	24	Degrees	354	198	167	173	180	174	162	25	10	13	357	352	332	S.
		2¾	do	24	Knots	0.09	0.13	0.55	0.62	0.53	0.20	0.13	0.14	0.34	0.35	0.40	0.38	0.17	0.04
B 2	1.4 miles S., 25° W. of Beavertail Light (41°25.7′ N., 71°24.8′ W.), Sept. 11-12.	¾	do	0	Degrees	309	------	189	222	214	248	299	281	278	304	333	358	346	W.
		¾	do	0	Knots	0.23	0.00	0.16	0.23	0.31	0.16	0.08	0.23	0.20	0.16	0.27	0.31	0.20	0.16
		¾	do	24	Degrees	308	218	202	222	185	------	269	266	269	286	336	355	335	W.
		¾	do	24	Knots	0.20	0.12	0.16	0.16	0.31	0.16	0.08	0.23	0.20	0.16	0.20	0.27	0.20	0.15
	H. L. MARINDIN, 1874 [2 3]																		
M 2	0.4 mile N., 45° W. of Fuller Rock Light (41°47.9′ N., 71°23.2′ W.), Oct. 10.	¼	Can	0-20	Degrees	------	------	------	134	136	------	------	------	------	------	------	------	------	------
		¼	do	0-20	Knots	------	------	------	0.56	0.53	------	------	------	------	------	------	------	------	------
M 3	0.1 mile N., 76° E. of Sassafras Point (41°48.0′ N., 71°23.4′ W.), Sept. 11-12.	¼	do	0-20	Degrees	------	------	------	119	140	132	------	------	328	331	322	------	------	------
		¼	do	0-20	Knots	------	------	------	0.08	0.14	0.16	------	------	0.10	0.17	0.35	------	------	------
M 4	0.2 mile north of Sassafras Point (41°48.2′ N., 71°23.6′ W.), Sept. 10-11.	½	do	0-15½	Degrees	316	------	------	131	144	149	------	326	328	318	312	304	316	------
		½	do	0-15½	Knots	0.39	0.00	------	0.50	0.50	0.46	------	0.58	0.35	0.29	0.48	0.48	0.39	------
M 5	0.2 mile S., 76° E. of east end State pier (41°48.4′ N., 71°23.7′ W.), Sept. 9-10.	¼	do	0	Degrees	328	------	141	140	152	156	159	------	339	334	341	330	328	------
		¼	do	0	Knots	0.39	0.00	0.39	0.55	0.51	0.78	0.29	------	0.12	0.10	0.49	0.49	0.39	------
M 6	0.2 mile N., 35° E. of east end State pier (41°48.6′ N., 71°23.8′ W.), Sept. 8-9, 25.	¼	do	0-15	Degrees	------	------	------	171	169	169	------	352	344	343	346	347	------	------
		¼	do	0-15	Knots	------	------	------	0.52	0.58	0.46	------	0.11	0.17	0.18	0.36	0.51	------	------
M 7, 8	0.1 mile S., 75° E. of Fox Point (41°48.8′ N., 71°23.8′ W.), Sept. 14-15, 19-20.	½	do	0-20	Degrees	------	------	------	227	208	203	194	32	39	------	------	------	------	------
		½	do	0-20	Knots	------	------	------	0.32	0.52	0.44	0.37	0.15	0.27	0.00	------	------	------	------
M 9	0.3 mile N., 48° E. of Fox Point (41°49.0′ N., 71°23.7′ W.), Sept. 15-16.	¼	do	0-15	Degrees	------	------	------	236	242	------	------	38	48	------	------	------	------	------
		¼	do	0-15	Knots	------	------	------	0.71	0.69	------	------	0.29	0.38	------	------	------	------	------
M 10	0.2 mile west of India Point (41°49.0′ N., 71°23.6′ W.), Sept. 17.	¼	do	0-20	Degrees	------	------	------	284	277	------	------	96	96	------	------	------	------	------
		¼	do	0-20	Knots	------	------	------	1.88	1.38	------	------	0.31	0.20	------	------	------	------	------
M 11	Off India Point (41°49.0′ N., 71°23.4′ W), Sept. 17.	¼	do	0-20	Degrees	------	------	------	256	265	------	------	64	66	------	------	------	------	------
		¼	do	0-20	Knots	------	------	------	1.67	1.70	------	------	1.30	0.94	------	------	------	------	------
M 11½	North side of railroad bridge, India Point (41°49.0′ N., 71°23.3′ W)., Oct. 9.	¼	do	0-20	Degrees	------	------	------	208	210	204	------	27	24	26	------	------	------	------
		¼	do	0-20	Knots	------	------	------	1.07	1.77	1.40	------	0.14	0.62	0.55	------	------	------	------
M 12	0.1 mile north of center of Washington Highway Bridge (41°49.2′ N., 71°23.3′ W.), Sept. 23.	¼	do	0-20	Degrees	------	------	------	186	177	169	------	354	342	332	------	------	------	------
		¼	do	0-20	Knots	------	------	------	0.30	0.47	0.66	------	0.20	0.30	0.20	------	------	------	------
M 13	0.2 mile north of center of Washington Highway Bridge (41°49.3′ N., 71°23.3′ W.), Sept. 23.	¼	do	0-20	Degrees	------	------	------	180	172	179	------	358	338	340	------	------	------	------
		¼	do	0-20	Knots	------	------	------	0.51	0.56	0.27	------	0.10	0.25	0.20	------	------	------	------
M 14	0.3 mile north of center of Washington Highway Bridge (41°49.4′ N., 71°23.3′ W.), Sept. 23.	¼	do	0-20	Degrees	------	------	------	230	233	234	------	20	21	46	------	------	------	------
		¼	do	0-20	Knots	------	------	------	0.54	0.81	0.61	------	0.20	0.27	0.20	------	------	------	------
M 15	Tunnel bridge, east side of channel (41°49.4′ N., 71°23.1′ W.), Sept. 24.	¼	do	0-20	Degrees	------	------	------	228	233	262	------	------	78	------	------	------	------	------
		¼	do	0-20	Knots	------	------	------	0.60	0.71	0.98	------	0.00	0.27	------	------	------	------	------
M 16	0.1 mile south of Cold Spring Point (41°49.5′ N., 71°23.0′ W.), Sept. 24.	¼	do	0-20	Degrees	------	------	------	214	215	------	------	40	26	------	------	------	------	------
		¼	do	0-20	Knots	------	------	------	0.56	0.56	------	------	0.18	0.18	------	------	------	------	------
M 17	East of Cold Spring Point (41°49.6′ N., 71°22.9′ W.), Sept. 24.	¼	do	0-20	Degrees	------	------	------	223	218	------	------	24	14	------	------	------	------	------
		¼	do	0-20	Knots	------	------	------	1.07	0.95	------	------	0.36	0.49	------	------	------	------	------
	J. E. PILLSBURY, 1889 [2]																		
P 1	0.6 mile S., 16° W. of south end, Gould Island (41°31.2′ N., 71°20.9′ W.), Aug. 1-12.	5½	do	12	(1)	S.	S.	S.	S.	S.	S.	N.	N.	N.	N.	N.	N.	N.	S.
		5½	do	12	Knots	0.02	0.31	0.52	0.51	0.32	0.03	0.03	0.05	0.04	0.12	0.18	0.18	0.07	0.09
		5½	do	60	(1)	N.	S.	S.	S.	S.	N.	N.	N.	N.	N.	N.	N.	N.	N.
		5½	do	60	Knots	0.06	0.06	0.23	0.26	0.06	0.02	0.04	0.06	0.20	0.37	0.65	0.55	0.17	0.13
P 2	0.6 mile S., 20° E. of south end of Gould Island (41°31.2′ N., 71°20.4′ W.), Aug. 2-3, 7-8.	2	do	12	(1)	S.	S.	S.	S.	S.	S.	------	N.	N.	N.	N.	N.	S.	S.
		2	do	12	Knots	0.10	0.51	0.69	0.54	0.50	0.18	0.00	0.02	0.04	0.08	0.20	0.12	0.02	0.16
		2	do	60	(1)	S.	S.	S.	S.	S.	------	------	------	N.	N.	N.	N.	N.	N.
		2	do	60	Knots	0.08	0.28	0.48	0.25	0.08	0.00	0.00	0.00	0.15	0.35	0.48	0.32	0.08	0.02
P 3	0.6 mile N., 21° E. of Taylor Point (41°31.2′ N., 71°21.3′ W.), Aug. 4-5, 9-10.	1¾	do	12	(1)	------	S.	S.	S.	S.	S.	N.	N.	N.	N.	N.	N.	------	S.
		1¾	do	12	Knots	0.00	0.13	0.37	0.42	0.44	0.07	0.06	0.07	0.02	0.04	0.09	0.09	0.00	0.09
		1¾	do	60	(1)	S.	S.	S.	S.	S.	S.	N.	N.	N.	N.	N.	N.	------	S.
		1¾	do	60	Knots	0.02	0.26	0.40	0.19	0.07	0.02	0.03	0.06	0.07	0.11	0.26	0.16	0.00	0.02
	BRENTON REEF LIGHTSHIP, 1930-31 [3]																		
LS	1.5 miles S., 44° E. of Beavertail Light (41°25.9′ N., 71°22.6′ W.), July 27, 1930-July 31, 1931.	370	Pole	7	Degrees	328	176	169	170	175	175	178	338	345	345	345	343	340	S.
		370	do	7	Knots	0.11	0.18	0.41	0.54	0.54	0.38	0.10	0.06	0.13	0.23	0.33	0.35	0.27	0.06
	J. C. SAMMONS, 1930																		
S 18	0.3 mile east of Narragansett pier (41°25.7′ N., 71°27.0′ W.), Aug. 29-30.	1	do	7	Degrees	6	31	68	30	20	25	1	10	11	31	8	20	26	NE.
		1	do	7	Knots	0.23	0.12	0.12	0.06	0.12	0.17	0.29	0.12	0.20	0.03	0.15	0.23	0.35	0.13
		1	Meter	7	do	0.43	0.23	0.35	0.46	0.41	0.46	0.41	0.41	0.27	0.20	0.38	0.35	0.46	------
		1	do	18	do	0.43	0.23	0.35	0.41	0.35	0.41	0.35	0.35	0.27	0.23	0.43	0.35	0.35	------
		1	do	29	do	0.38	0.23	0.35	0.41	0.41	0.35	0.35	0.35	0.27	0.35	0.38	0.35	0.35	------
S 19	0.1 mile west of Whale Rock Light (41°26.7′ N., 71°25.6′ W.), July 22-23.	1	Pole	7	Degrees	235	186	188	196	202	202	252	297	349	18	7	359	356	SW.
		1	do	7	Knots	0.05	0.15	0.57	0.77	0.77	0.52	0.21	0.05	0.13	0.26	0.41	0.31	0.15	0.14
		1	Meter	11	do	0.41	0.46	0.62	0.88	0.88	0.67	0.36	0.41	0.44	0.41	0.52	0.41	0.46	------
		1	do	27	do	0.41	0.41	0.67	0.77	0.67	0.46	0.41	0.36	0.48	0.46	0.52	0.52	0.36	------
		1	do	43	do	0.41	0.46	0.62	0.62	0.62	0.46	0.41	0.36	0.44	0.46	0.46	0.41	0.36	------
S 20	0.3 mile S., 60° E. of Watsons pier (41°27.4′ N., 71°25.3′ W.), July 21-22.	1	Pole	7	Degrees	46	170	152	197	201	205	358	2	20	301	8	14	14	N
		1	do	7	Knots	0.34	0.34	0.46	0.52	0.40	0.23	0.17	0.43	0.46	0.40	0.52	0.52	0.34	0.05
		1	Meter	10	do	0.46	0.52	0.69	0.86	0.63	0.58	0.46	0.58	0.52	0.52	0.58	0.58	0.46	------
		1	do	23	do	0.40	0.52	0.75	0.75	0.69	0.46	0.63	0.63	0.52	0.46	0.58	0.52	0.46	------
		1	do	37	do	0.40	0.46	0.58	0.75	0.58	0.58	0.40	0.52	0.52	0.58	0.58	0.46	0.34	------

See footnotes at end of table.

TABLE 1.—*Current Data, Narragansett Bay—Continued*

Station	Observer, location, and date	Observations			True directions and velocities														
						Hours after high water													
		Period	Method	Depth	Units	0	1	2	3	4	5	6	7	8	9	10	11	12	Non-tidal current [1]
	J. C. SAMMONS, 1930—Continued	*Days*		*Feet*															
S 21	0.8 mile N., 48° W. of Beaver Tail Light (41° 27.5′ N., 71°24.7′ W.), July 21–23.	2	Pole	7	Degrees	16	186	187	191	185	180	194	199	198	358	6	6	10	S.
		2	do	7	Knots	0.02	0.32	0.63	0.73	0.95	0.99	0.56	0.28	0.02	0.13	0.35	0.43	0.30	0.24
		2	Meter	10	do	0.43	0.45	0.59	0.84	0.95	0.89	0.43	0.43	0.35	0.43	0.49	0.45	0.43	------
		2	do	25	do	0.35	0.43	0.52	0.70	0.65	0.43	0.35	0.43	0.30	0.43	0.65	0.56	0.43	------
		2	do	40	do	0.35	0.38	0.52	0.54	0.45	0.29	0.38	0.38	0.28	0.40	0.54	0.49	0.38	------
S 22	0.5 mile N., 21° W. of Beavertail Light (41°27.4′ N., 71°24.2′ W.), July 21–22.	1	Pole	3¼	Degrees	------	177	182	178	180	190	198	286	27	346	------	3	330	S.
		1	do	3¼	Knots	0.00	0.29	0.80	1.04	1.04	0.75	0.40	0.15	0.06	0.23	0.00	0.23	0.29	0.24
		1	Meter	9	do	0.34	0.40	0.63	0.98	0.92	0.63	0.46	0.49	0.34	0.46	0.46	0.52	0.34	------
		1	do	23	do	0.29	0.40	0.69	0.69	0.63	0.46	0.69	0.58	0.40	0.58	0.52	0.58	0.40	------
		1	do	36	do	0.29	0.46	0.58	0.63	0.63	0.40	0.63	0.54	0.52	0.58	0.52	0.46	0.34	------
S 23 [4]	0.2 mile S., 71° W. of Bonnet Point (41°28.1′ N., 71°25.5′ W.), July 22–23.	1	Pole	3¼	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
		1	do	3¼	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
		1	Meter	4	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
		1	do	10	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
		1	do	16	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
S 24	0.1 mile S., 71° E. of Dutch Island Light (41°29.8′ N., 71°24.2′ W.), July 23–25.	2	Pole	7	Degrees	238	232	226	228	241	256	63	27	32	32	32	17	322	SW.
		2	do	7	Knots	0.42	0.57	0.88	0.90	0.72	0.33	0.13	0.31	0.40	0.62	0.84	0.75	0.25	0.05
		2	Meter	11	do	0.44	0.46	0.90	0.95	0.81	0.42	0.22	0.31	0.40	0.63	0.88	0.79	0.18	------
		2	do	27	do	0.11	0.48	0.84	0.88	0.70	0.42	0.25	0.40	0.42	0.70	0.90	0.77	0.19	------
		2	do	43	do	0.15	0.51	0.79	0.75	0.62	0.33	0.31	0.42	0.51	0.74	0.79	0.66	0.33	------
S 25	0.6 mile N., 24° W. of Dutch Island Light (41°30.3′ N., 71°24.6′ W.), July 23–24.	1	Pole	7	Degrees	324	207	195	200	202	201	208	23	20	21	20	10	356	------
		1	do	7	Knots	0.32	0.72	0.90	1.17	0.90	0.45	0.18	0.32	0.50	0.84	1.08	1.04	0.54	0.00
		1	Meter	7	do	0.27	0.68	0.90	1.26	1.04	0.63	0.36	0.40	0.50	0.81	1.08	1.08	0.58	------
		1	do	17	do	0.27	0.50	0.81	0.81	0.72	0.50	0.32	0.40	0.50	0.78	0.76	0.76	0.40	------
		1	do	26	do	0.32	0.36	0.54	0.45	0.45	0.40	0.22	0.22	0.36	0.54	0.58	0.54	0.22	------
S 26	0.7 mile N., 45° W. of Dutch Island Light (41°30.3′ N., 71°25.0′ W.) July 23–24.	1	Pole	3¼	Degrees	238	232	202	204	188	182	15	340	4	23	13	35	4	S.
		1	do	3¼	Knots	0.05	0.32	1.30	0.86	0.54	0.09	0.22	0.36	0.36	0.45	0.45	0.58	0.27	0.02
		1	Meter	9	do	0.22	0.22	0.94	0.81	0.58	0.36	0.27	0.36	0.45	0.48	0.63	0.54	0.22	------
		1	do	23	do	0.18	0.27	0.54	0.68	0.45	0.32	0.22	0.27	0.36	0.66	0.63	0.36	0.09	------
		1	do	36	do	0.14	0.22	0.54	0.50	0.27	0.22	0.27	0.40	0.50	0.51	0.58	0.45	0.18	------
S 27	0.1 mile N., 65° E. of north end of Dutch Island (41°30.5′ N., 71°23.8′ W.), July 24–25.	1	Pole	3¼	Degrees	124	160	152	152	151	146	329	4	109	350	53	109	116	SE.
		1	do	3¼	Knots	0.40	0.77	0.97	1.09	0.89	0.20	0.08	0.20	0.12	0.20	0.19	0.20	0.28	0.41
		1	Meter	6	do	0.40	0.57	0.97	1.05	0.85	0.32	0.20	0.24	0.16	0.28	0.24	0.12	0.28	------
		1	do	15	do	0.40	0.53	0.85	1.01	0.81	0.28	0.16	0.28	0.24	0.28	0.32	0.04	0.20	------
		1	do	24	do	0.40	0.53	0.98	0.97	0.69	0.28	0.12	0.20	0.20	0.20	0.30	0.12	0.12	------
S 28	*0.4 mile N., 50° E. of north end of Dutch Island (41°30.7′ N., 71°23.5′ W.), July 24–25.*	1	Pole	7	Degrees	------	148	152	152	142	86	343	333	358	345	336	348	338	NW.
		1	do	7	Knots	0.00	0.65	0.57	0.61	0.40	0.16	0.20	0.32	0.40	0.61	0.85	0.77	0.45	0.12
		1	Meter	7	do	0.20	0.73	0.77	0.73	0.57	0.20	0.24	0.40	0.40	0.65	0.85	0.81	0.40	------
		1	do	17	do	0.16	0.57	0.53	0.53	0.36	0.16	0.28	0.40	0.36	0.57	0.73	0.77	0.45	------
		1	do	26	do	0.16	0.40	0.40	0.36	0.24	0.12	0.32	0.40	0.36	0.49	0.69	0.69	0.36	------
S 29	0.7 mile N., 67° E. of Plum Beach Light (41° 32.1′ N., 71°23.5′ W.), Sept. 15–16.	1	Pole	3½	Degrees	29	198	182	192	187	------	18	10	22	30	22	26	3	N.
		1	do	3½	Knots	0.29	0.22	0.66	0.66	0.07	0.00	0.36	0.15	0.15	0.36	0.51	0.63	0.29	0.06
		1	Meter	4	do	0.29	0.29	0.66	0.66	0.15	0.44	0.51	0.44	0.29	0.44	0.80	0.69	0.29	------
		1	do	16	do	0.15	0.36	0.58	0.36	0.15	0.21	0.36	0.36	0.29	0.29	0.58	0.63	0.15	------
S 30	0.5 mile N., 52° E. of Plum Beach Light (41°32.1′ N., 71°23.9′ W.), Sept. 15–16.	1	Pole	7	Degrees	30	162	147	157	178	155	340	0	352	1	5	17	21	N.
		1	do	7	Knots	0.36	0.15	0.44	0.73	0.51	0.36	0.36	0.44	0.36	0.44	0.58	0.83	0.73	0.10
		1	Meter	13	do	0.58	0.29	0.66	0.88	0.73	0.29	0.29	0.29	0.36	0.44	0.66	0.88	0.80	------
		1	do	33	do	0.66	0.29	0.66	0.80	0.58	0.22	0.36	0.44	0.22	0.44	0.58	0.77	0.51	------
		1	do	52	do	0.51	0.22	0.58	0.80	0.51	0.22	0.44	0.36	0.36	0.29	0.44	0.54	0.51	------
S 31	0.4 mile N., 26° W. of Plum Beach Light (41°32.2′ N., 71°24.6′ W.), Sept. 15–16.	1	Pole	7	Degrees	104	139	145	154	152	------	354	352	354	9	2	8	26	S.
		1	do	7	Knots	0.36	0.66	0.88	0.80	0.36	0.00	0.36	0.36	0.29	0.22	0.58	0.80	0.44	0.01
		1	Meter	5	do	0.36	0.73	0.80	0.80	0.58	0.15	0.44	0.51	0.36	0.44	0.73	0.80	0.44	------
		1	do	12	do	0.36	0.73	0.88	0.80	0.44	0.29	0.36	0.29	0.36	0.44	0.66	0.73	0.44	------
		1	do	19	do	0.29	0.58	0.73	0.58	0.36	0.29	0.36	0.36	0.29	0.36	0.51	0.73	0.51	------
S 32	0.1 mile west of south end of Fox Island (41°33.2′ N., 71°25.3′ W.), Sept. 15–16.	1	Pole	3¼	Degrees	333	107	112	118	107	358	324	346	24	8	312	344	------	N.
		1	do	3¼	Knots	0.07	0.36	0.44	0.66	0.07	0.29	0.51	0.44	0.36	0.29	0.51	0.51	0.00	0.09
		1	Meter	4	do	0.29	0.51	0.51	0.44	0.44	0.22	0.73	0.51	0.36	0.29	0.58	0.51	0.36	------
		1	do	14	do	0.36	0.44	0.44	0.44	0.29	0.29	0.73	0.51	0.29	0.44	0.73	0.58	0.36	------
S 33	0.1 mile N., 45° W. of Old Gay Rock Light (41°34.4′ N., 71°26.3′ W.), July 11–12.	1	Pole	3½	Degrees	15	88	128	88	94	------	------	------	259	272	294	312	------	E.
		1	do	3½	Knots	0.11	0.05	0.21	0.16	0.21	0.00	0.00	0.00	0.05	0.11	0.16	0.11	------	0.02
		1	Meter	4	do	0.21	0.21	0.32	0.16	0.16	0.16	0.05	0.16	0.11	0.27	0.21	0.18	------	------
		1	do	14	do	0.16	0.21	0.21	0.11	0.11	0.16	0.05	0.21	0.11	0.27	0.27	0.18	------	------
S 34	Mouth of Wickford Cove (41°34.4′ N., 71°26.7′ W.), July 11–12.	1	Pole	3¼	Degrees	------	------	36	39	38	123	22	200	202	------	199	------	------	NE.
		1	do	3¼	Knots	0.00	0.05	0.21	0.27	0.27	0.21	0.05	0.27	0.16	0.00	0.03	0.00	------	0.05
		1	Meter	2	do	0.11	0.11	0.37	0.27	0.32	0.21	0.16	0.11	0.11	0.00	0.11	0.11	------	------
		1	do	8	do	0.05	0.00	0.27	0.21	0.32	0.11	0.00	0.21	0.05	0.16	0.18	0.18	------	------
S 35	Off south end Cornelius Island (41°34.7′ N., 71°26.9′ W.), July 11–12.	1	Pole	3½	Degrees	------	137	138	122	111	127	------	294	2	287	290	345	------	E.
		1	do	3½	Knots	0.00	0.05	0.27	0.16	0.21	0.21	0.00	0.05	0.21	0.11	0.59	0.14	------	0.02
		1	Meter	3	do	0.11	0.11	0.21	0.37	0.27	0.21	0.05	0.11	0.16	0.16	0.64	0.32	------	------
		1	do	12	do	0.11	0.16	0.21	0.21	0.21	0.21	0.05	0.32	0.27	0.21	0.75	0.43	------	------
S 36	0.5 mile S., 55° W. of North Point Light (41°34.1′ N., 71°22.9′ W.), July 10–11.	1	Pole	3¼	Degrees	------	233	206	196	180	------	44	26	62	74	49	66	88	------
		1	do	3¼	Knots	0.15	0.05	0.52	0.52	0.41	0.00	0.21	0.21	0.26	0.24	0.31	0.26	0.15	0.00
		1	Meter	6	do	0.15	0.15	0.41	0.46	0.36	0.26	0.26	0.31	0.31	0.24	0.36	0.26	0.10	------
		1	do	15	do	0.15	0.21	0.41	0.52	0.36	0.21	0.31	0.26	0.21	0.28	0.36	0.26	0.15	------
		1	do	24	do	0.15	0.15	0.36	0.52	0.46	0.15	0.31	0.31	0.21	0.34	0.31	0.26	0.10	------
S 37	0.9 mile N., 83° W. of North Point Light (41°34.5′ N., 71°23.5′ W.), July 10–11.	1	Pole	7	Degrees	------	194	188	192	186	168	58	66	26	40	43	56	59	S.
		1	do	7	Knots	0.00	0.31	0.57	0.62	0.41	0.15	0.10	0.21	0.15	0.07	0.15	0.21	0.05	0.08
		1	Meter	6	do	0.10	0.26	0.41	0.57	0.46	0.21	0.21	0.26	0.05	0.28	0.26	0.21	0.05	------
		1	do	14	do	0.15	0.26	0.52	0.67	0.52	0.10	0.21	0.21	0.05	0.28	0.31	0.31	0.10	------
		1	do	22	do	0.10	0.21	0.41	0.41	0.36	0.15	0.26	0.41	0.05	0.31	0.31	0.31	0.05	------
S 38	0.2 mile S., 42° E. of Quonset Point (41°35.1′ N., 71°24.2′ W.), July 10–11.	1	Pole	7	Degrees	193	196	188	182	151	64	48	56	48	36	46	53	199	N.
		1	do	7	Knots	0.05	0.36	0.57	0.46	0.05	0.36	0.57	0.46	0.31	0.26	0.21	0.15	0.05	0.05
		1	Meter	7	do	0.26	0.57	0.62	0.57	0.31	0.41	0.67	0.46	0.36	0.31	0.36	0.21	0.21	------
		1	do	17	do	0.21	0.46	0.62	0.52	0.31	0.41	0.67	0.46	0.26	0.31	0.36	0.26	0.21	------
		1	do	26	do	0.15	0.26	0.46	0.52	0.21	0.36	0.57	0.46	0.26	0.26	0.31	0.15	0.10	------

See footnotes at end of table.

TABLE 1.—*Current Data, Narragansett Bay—Continued*

Station	Observer, location, and date	Observations			True directions and velocities														
		Period	Method	Depth	Units	Hours after high water: 0	1	2	3	4	5	6	7	8	9	10	11	12	Nontidal current[1]
	J. C. SAMMONS, 1930—Continued	*Days*		*Feet*															
S 39[4]	0.2 mile north of North Point Light (41°34.6′ N., 71°22.3′ W.), July 9–10.	1	Pole	3¼	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
		1	do	3¼	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
		1	Meter	5	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
		1	do	12	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
		1	do	19	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
S 40	0.7 mile north of North Point Light (41°35.2′ N., 71°22.4′ W.), July 9–10.	1	Pole	7	Degrees	89	166	180	196	190	240	307	320	321	335	300	2	286	S.
		1	do	7	Knots	0.05	0.37	0.48	0.37	0.32	0.11	0.16	0.26	0.24	0.16	0.11	0.21	0.21	0.01
		1	Meter	5	do	0.26	0.42	0.53	0.37	0.37	0.26	0.32	0.26	0.32	0.16	0.26	0.37	0.21	------
		1	do	12	do	0.26	0.37	0.42	0.37	0.37	0.16	0.26	0.21	0.24	0.16	0.16	0.32	0.21	------
		1	do	20	do	0.21	0.32	0.21	0.42	0.26	0.21	0.42	0.26	0.32	0.32	0.21	0.32	0.21	------
S 41	0.2 mile south of south end of Hope Island (41°35.6′ N., 71°22.3′ W.), July 9–10.	1	Pole	7	Degrees	239	148	210	206	296	348	340	340	315	310	307	289	251	N.
		1	do	7	Knots	0.16	0.26	0.16	0.16	0.21	0.11	0.21	0.26	0.18	0.11	0.16	0.16	0.21	0.04
		1	Meter	5	do	0.26	0.37	0.32	0.26	0.26	0.32	0.32	0.37	0.29	0.16	0.16	0.26	0.32	------
		1	do	12	do	0.26	0.32	0.26	0.32	0.16	0.26	0.21	0.37	0.29	0.16	0.26	0.26	0.32	------
		1	do	19	do	0.37	0.42	0.26	0.32	0.26	0.37	0.26	0.37	0.24	0.21	0.21	0.42	0.21	------
S 42	0.1 mile S., 70° W. of Gooseberry Island (41°36.2′ N., 71°22.3′ W.), July 8–9.	1	Pole	3¼	Degrees	209	194	177	177	181	180	164	32	68	187	172	195	216	SE.
		1	do	3¼	Knots	0.41	0.49	0.33	0.22	0.33	0.06	0.11	0.22	0.28	0.33	0.22	0.06	0.11	0.10
		1	Meter	7	do	0.41	0.49	0.38	0.28	0.28	0.22	0.44	0.44	0.38	0.38	0.38	0.22	0.22	------
		1	do	18	do	0.30	0.49	0.33	0.28	0.22	0.22	0.44	0.48	0.33	0.38	0.33	0.22	0.11	------
		1	do	29	do	0.25	0.28	0.33	0.22	0.16	0.23	0.44	0.52	0.33	0.28	0.22	0.22	0.11	------
S 43	0.6 mile N., 76° W. of Gooseberry Island (41°36.3′ N., 71°23.0′ W.), July 8–9.	1	Pole	7	Degrees	29	166	167	190	186	186	11	43	183	16	20	16	11	S.
		1	do	7	Knots	0.22	0.11	0.33	0.44	0.38	0.11	0.22	0.14	0.11	0.11	0.28	0.33	0.22	0.01
		1	Meter	6	do	0.25	0.21	0.38	0.44	0.38	0.17	0.28	0.33	0.28	0.33	0.33	0.38	0.33	------
		1	do	14	do	0.33	0.17	0.28	0.33	0.33	0.17	0.33	0.25	0.28	0.55	0.44	0.38	0.33	------
		1	do	22	do	0.25	0.28	0.38	0.38	0.28	0.06	0.28	0.41	0.55	0.33	0.38	0.38	0.33	------
S 44	1.1 miles N., 71° W. of Gooseberry Island (41°36.6′ N., 71°23.7′ W.), July 8–9.	1	Pole	7	Degrees	------	175	182	192	202	181	26	18	2	4	0	5	1	N.
		1	do	7	Knots	0.00	0.06	0.33	0.44	0.22	0.11	0.22	0.25	0.22	0.16	0.28	0.22	0.11	0.01
		1	Meter	5	do	0.16	0.22	0.50	0.66	0.44	0.28	0.22	0.25	0.28	0.28	0.28	0.28	0.28	------
		1	do	12	do	0.16	0.22	0.33	0.44	0.44	0.28	0.22	0.33	0.28	0.38	0.33	0.28	0.22	------
		1	do	19	do	0.11	0.28	0.28	0.22	0.16	0.16	0.28	0.30	0.22	0.33	0.33	0.33	0.28	------
S 45	0.2 mile north of Despair Island (41°36.6′ N., 71°21.7′ W.), July 7–8.	1	Pole	6¾	Degrees	110	142	147	151	134	145	154	143	154	110	28	74	109	S.
		1	do	6¾	Knots	0.27	0.38	0.54	0.60	0.54	0.47	0.05	0.11	0.27	0.11	0.16	0.22	0.27	0.21
		1	Meter	6	do	0.38	0.38	0.54	0.49	0.49	0.40	0.22	0.22	0.33	0.27	0.22	0.27	0.44	------
		1	do	15	do	0.27	0.33	0.44	0.54	0.49	0.29	0.11	0.33	0.33	0.38	0.22	0.27	0.27	------
		1	do	24	do	0.33	0.33	0.27	0.38	0.44	0.19	0.11	0.27	0.27	0.27	0.22	0.27	0.38	------
S 46	*0.8 mile S., 24° W. of Pine Hill Point (41°37.2′ N., 71°21.3.′ W.), July 7–8.*	1	Pole	7	Degrees	*68*	*142*	*158*	*162*	*154*	*156*	*120*	1	349	2	326	352	14	S.
		1	do	7	Knots	0.22	0.22	0.38	0.49	0.65	0.47	0.19	0.05	0.05	0.22	0.16	0.22	0.22	0.09
		1	Meter	5	do	0.22	0.33	0.44	0.60	0.65	0.54	0.19	0.11	0.16	0.11	0.22	0.27	0.33	------
		1	do	13	do	0.16	0.27	0.33	0.44	0.49	0.33	0.22	0.33	0.38	0.49	0.49	0.44	0.22	------
		1	do	21	do	0.33	0.27	0.22	0.16	0.16	0.25	0.22	0.38	0.16	0.22	0.33	0.38	0.33	------
S 47	0.2 mile S., 24° W. of Pine Hill Point (41°37.7′ N., 71°21.0′ W.), July 7–8.	1	Pole	7	Degrees	17	130	138	136	128	146	234	262	280	258	292	306	328	SE.
		1	do	7	Knots	0.05	0.33	0.44	0.49	0.33	0.11	0.11	0.16	0.16	0.11	0.22	0.27	0.27	0.05
		1	Meter	5	do	0.33	0.33	0.54	0.65	0.49	0.22	0.22	0.27	0.22	0.22	0.38	0.38	0.33	------
		1	do	14	do	0.33	0.22	0.38	0.38	0.16	0.27	0.25	0.27	0.27	0.27	0.27	0.33	0.33	------
		1	do	21	do	0.33	0.22	0.33	0.22	0.11	0.33	0.25	0.16	0.22	0.22	0.27	0.33	0.27	------
S 48	0.7 mile S., 30° W. of North Point, Prudence Island (41°39.5′ N., 71°21.2′ W.), Sept. 12–13.	1	Pole	3¼	Degrees	149	162	160	158	183	358	350	356	42	315	------	3	5	S.
		1	do	3¼	Knots	0.08	1.07	0.90	0.79	0.11	0.51	0.68	0.23	0.06	0.11	0.00	0.06	0.34	0.09
		1	Meter	2	do	0.19	0.85	0.85	0.73	0.17	0.56	0.68	0.23	0.28	0.28	0.28	0.45	0.23	------
		1	do	7	do	0.15	0.79	0.85	0.79	0.11	0.51	0.68	0.17	0.40	0.34	0.23	0.40	0.23	------
S 49	0.3 mile S., 46° E. of Warwick Light (41° 39.8′ N., 71°22.4′ W.), Sept. 12–13.	1	Pole	7	Degrees	38	260	224	210	238	210	39	47	30	36	31	43	29	NE.
		1	do	7	Knots	0.17	0.34	0.62	0.90	0.79	0.28	0.40	0.56	0.40	0.34	0.40	0.42	0.56	0.01
		1	Meter	11	do	0.25	0.45	0.79	1.13	0.90	0.56	0.51	0.62	0.45	0.40	0.45	0.45	0.45	------
		1	do	27	do	0.25	0.40	0.85	1.13	0.90	0.51	0.51	0.56	0.45	0.40	0.34	0.42	0.45	------
		1	do	44	do	0.25	0.40	0.79	1.02	0.79	0.62	0.51	0.56	0.51	0.40	0.34	0.42	0.45	------
S 50	0.5 mile N., 84° W. of Warwick Light (41°40.1′ N., 71°23.4′ W.), Sept. 12–13.	1	Pole	7	Degrees	------	52	115	122	119	93	88	328	288	304	296	266	------	SE.
		1	do	7	Knots	0.00	0.06	0.11	0.28	0.28	0.11	0.11	0.17	0.11	0.17	0.11	0.08	0.00	0.01
		1	Meter	7	do	0.19	0.17	0.28	0.40	0.34	0.17	0.28	0.23	0.23	0.28	0.26	0.26	0.23	------
		1	do	18	do	0.15	0.11	0.17	0.40	0.28	0.23	0.23	0.17	0.28	0.28	0.31	0.34	0.23	------
		1	do	29	do	0.15	0.23	0.17	0.34	0.28	0.17	0.28	0.23	0.23	0.17	0.34	0.26	0.00	------
S 51	0.7 mile west of Warwick Light (41°40.0′ N., 71°23.7′ W.), Sept. 12–13.	1	Pole	3½	Degrees	------	137	146	140	129	59	13	16	354	------	------	12	------	SE.
		1	do	3½	Knots	0.00	0.11	0.34	0.23	0.17	0.11	0.23	0.17	0.11	0.00	0.00	0.11	0.00	0.02
		1	Meter	2	do	0.20	0.28	0.40	0.45	0.34	0.40	0.34	0.28	0.23	0.17	0.11	0.23	0.11	------
		1	do	8	do	0.14	0.17	0.40	0.34	0.28	0.28	0.34	0.28	0.17	0.17	0.17	0.14	0.00	------
S 52	0.8 mile S., 48° E. of North Point, Prudence Island (41°39.5′ N., 71°20.0′ W.), July 29–30.	1	Pole	7	Degrees	106	152	150	162	151	136	------	355	------	327	348	358	18	SE.
		1	do	7	Knots	0.04	0.06	0.21	0.34	0.17	0.13	0.00	0.04	0.00	0.04	0.21	0.17	0.13	0.02
		1	Meter	6	do	0.13	0.11	0.25	0.38	0.25	0.17	0.08	0.17	0.08	0.17	0.25	0.25	0.13	------
		1	do	14	do	0.13	0.11	0.17	0.29	0.25	0.21	0.08	0.08	0.04	0.13	0.21	0.21	0.17	------
		1	do	22	do	0.13	0.06	0.21	0.21	0.25	0.17	0.17	0.08	0.04	0.08	0.17	0.21	0.13	------
S 53	1.1 miles N., 58° W. of Popasquash Point (41°39.5′ N., 71°19.2′ W.), July 29–30.	1	Pole	7	Degrees	339	172	173	172	168	183	21	39	------	356	350	353	354	S.
		1	do	7	Knots	0.04	0.08	0.25	0.38	0.34	0.17	0.04	0.04	0.00	0.08	0.21	0.21	0.08	0.05
		1	Meter	5	do	0.08	0.29	0.34	0.42	0.38	0.25	------	0.08	0.04	0.08	0.25	0.13	0.00	------
		1	do	13	do	0.13	0.04	0.21	0.38	0.38	0.21	------	0.04	0.04	0.17	0.17	0.34	0.34	------
		1	do	21	do	0.13	0.00	0.17	0.25	0.25	0.17	------	0.00	0.04	0.17	0.25	0.21	0.17	------
S 54	0.7 mile N., 37° W. of Popasquash Point (41°39.5′ N., 71°18.5′ W.), July 29–30.	1	Pole	3¼	Degrees	------	158	171	172	172	169	11	358	78	358	12	11	------	S.
		1	do	3¼	Knots	0.00	0.29	0.46	0.50	0.38	0.17	0.08	0.08	0.08	0.21	0.17	0.13	0.00	0.08
		1	Meter	6	do	0.08	0.34	0.46	0.46	0.38	0.13	0.08	0.08	0.13	0.17	0.29	0.21	0.08	------
		1	do	15	do	0.13	0.11	0.29	0.34	0.25	0.08	0.08	0.13	0.04	0.21	0.38	0.21	0.25	------
		1	do	24	do	0.08	0.11	0.25	0.29	0.08	0.17	0.21	0.13	0.08	0.38	0.42	0.34	0.21	------
S 55	0.7 mile N., 47° W. of North Point, Popasquash Neck (41°41.4′ N., 71°18.8′ W.), July 30–31.	1	Pole	3¼	Degrees	157	121	134	176	185	163	166	66	------	------	208	59	152	S.
		1	do	3¼	Knots	0.14	0.04	0.22	0.45	0.32	0.22	0.18	0.04	0.00	0.00	0.09	0.14	0.27	0.13
		1	Meter	8	do	0.22	0.36	0.36	0.40	0.36	0.27	0.22	0.14	0.09	0.14	0.18	0.18	0.09	------
		1	do	18	do	0.40	0.22	0.22	0.18	0.09	0.18	0.32	0.36	0.36	0.40	0.45	0.22	0.32	------
		1	do	28	do	0.18	0.36	0.18	0.14	0.09	0.18	0.32	0.40	0.32	0.36	0.50	0.27	0.40	------

See footnotes at end of table.

TABLE 1.—*Current Data, Narragansett Bay—Continued*

Station	Observer, location, and date	Observations			True directions and velocities	Hours after high water													Non-tidal current[1]
		Period	Method	Depth	Units	0	1	2	3	4	5	6	7	8	9	10	11	12	
	J. C. SAMMONS, 1930—Continued	Days		Feet															
S 56	0.5 mile N. 71° W. of Conimicut Point Light (41°43.2′ N., 71°21.3′ W.), July 30–31.	1	Pole	3½	Degrees	112	121	116	117	113				112			114	94	
		1	do	3½	Knots	0.22	0.45	0.36	0.36	0.45				0.18	0.00	0.00	0.04	0.22	
		1	Meter	2	do	0.50	0.54	0.50	0.40	0.36	0.32	0.18	0.18	0.14	0.09	0.14	0.14	0.22	
		1	do	8	do	0.40	0.40	0.27	0.36	0.45	0.32	0.09	0.14	0.09	0.04	0.14	0.04	0.22	
S 57	0.3 mile N. 40° W. of Conimicut Point Light (41°43.3′ N., 71°21.0′ W.), July 30–31.	1	Pole	7	Degrees	92	104	118	132	120	88	123	159	117	318	254	31	77	SE.
		1	do	7	Knots	0.18	0.36	0.58	0.54	0.50	0.40	0.09	0.09	0.22	0.04	0.18	0.14	0.09	0.22
		1	Meter	10	do	0.18	0.32	0.40	0.58	0.58	0.36	0.04	0.04	0.09	0.14	0.22	0.27	0.09	
		1	do	25	do	0.09	0.22	0.36	0.50	0.40	0.18	0.36	0.22	0.22	0.27	0.27	0.50	0.14	
		1	do	40	do	0.09	0.22	0.36	0.50	0.50	0.18	0.54	0.54	0.09	0.22	0.09	0.36	0.09	
S 58	0.4 mile N. 10° E. of Conimicut Point Light (41°43.5′ N., 71°20.6′ W.), July 30–31.	1	Pole	3½	Degrees	155	162	153	160	168	135		317	305	332	326	296	319	SE.
		1	do	3½	Knots	0.04	0.04	0.60	0.63	0.36	0.04	0.00	0.04	0.04	0.14	0.22	0.54	0.09	0.05
		1	Meter	6	do	0.18	0.32	0.57	0.58	0.32	0.27	0.32	0.27	0.36	0.40	0.50	0.45	0.27	
		1	do	10	do	0.22	0.14	0.51	0.50	0.36	0.22	0.32	0.45	0.36	0.50	0.45	0.68	0.27	
		1	do	16	do	0.27	0.14	0.42	0.45	0.27	0.27	0.36	0.27	0.36	0.36	0.63	0.72	0.27	
S 59	0.5 mile N. 35° W. of Sabine Point Light (41°46.2′ N., 71°23.0′ W.), July 31–Aug. 1.	1	Pole	3½	Degrees		176	170	178	178	161	354	0	351	351	348	350	5	N.
		1	do	3½	Knots	0.00	0.25	0.30	0.40	0.23	0.10	0.25	0.30	0.15	0.10	0.10	0.25	0.15	0.01
		1	Meter	3	do	0.15	0.30	0.40	0.40	0.27	0.15	0.25	0.20	0.20	0.20	0.25	0.25	0.15	
		1	do	11	do	0.10	0.30	0.40	0.35	0.20	0.15	0.25	0.15	0.10	0.10	0.20	0.15	0.25	
S 60	0.4 mile S. 22° W. of Pomham Rocks Light (41°46.3′ N., 71°22.4′ W.), July 31–Aug. 1.	1	Pole	3¼	Degrees		163	186	194	188	174			142			12		S.
		1	do	3¼	Knots	0.00	0.35	0.30	0.35	0.47	0.20	0.00	0.00	0.15	0.00	0.00	0.10	0.00	0.15
		1	Meter	7	do	0.05	0.30	0.40	0.45	0.50	0.15	0.15	0.10	0.25	0.15	0.20	0.20	0.15	
		1	do	16	do	0.20	0.05	0.05	0.25	0.30	0.10	0.15	0.25	0.30	0.25	0.35	0.40	0.35	
		1	do	26	do	0.30	0.10	0.00	0.35	0.27	0.05	0.10	0.40	0.30	0.40	0.45	0.50	0.40	
S 61	0.1 mile N. 60° W. of Fuller Rock Light (41°47.7′ N., 71°23.0′ W.), July 31–Aug. 2.	2	Pole	7	Degrees	324	138	144	137	139	149			150	69	333	334	323	SE.
		2	do	7	Knots	0.13	0.16	0.33	0.31	0.37	0.20	0.00	0.00	0.22	0.09	0.20	0.31	0.33	0.05
		2	Meter	6	do	0.16	0.31	0.35	0.44	0.41	0.28	0.02	0.05	0.24	0.13	0.16	0.24	0.33	
		2	do	15	do	0.27	0.20	0.38	0.44	0.44	0.13	0.02	0.13	0.05	0.05	0.33	0.46	0.41	
		2	do	24	do	0.31	0.13	0.20	0.22	0.13	0.15	0.49	0.52	0.41	0.33	0.46	0.46	0.38	
S 62	0.2 mile N. 70° E. of Fox Point (41°48.9′ N., 71°23.7′ W.), Aug. 1–2.	1	Pole	3½	Degrees		202	71	42		198		48		47	48	52	38	NE.
		1	do	3½	Knots	0.00	0.06	0.12	0.12	0.00	0.03	0.00	0.17	0.00	0.06	0.17	0.29	0.23	0.06
		1	Meter	4	do	0.23	0.23	0.23	0.23	0.23	0.20	0.17	0.17	0.06	0.00	0.29	0.34	0.46	
		1	do	12	do	0.23	0.29	0.23	0.12	0.12	0.15	0.06	0.17	0.06	0.06	0.23	0.23	0.34	
S 63	0.1 mile N. 30° E. of Fox Point (41°48.9′ N., 71°23.9′ W.), Aug. 1–2.	1	Pole	3¼	Degrees	79	89	203	228	223	224	209				68	28	40	SW.
		1	do	3¼	Knots	0.23	0.12	0.58	0.63	0.46	0.49	0.06	0.00	0.00	0.00	0.12	0.40	0.46	0.08
		1	Meter	4	do	0.34	0.23	0.52	0.58	0.86	0.58	0.17	0.06	0.06	0.12	0.17	0.34	0.46	
		1	do	11	do	0.23	0.12	0.58	0.63	0.80	0.31	0.12	0.17	0.00	0.12	0.23	0.40	0.52	
		1	do	18	do	0.17	0.23	0.58	0.34	0.34	0.38	0.23	0.06	0.00	0.12	0.29	0.29	0.34	
S 64[4]	*0.1 mile N. 78° W. of Fox Point (41°48.8′ N., 71°24.1′ W.), Aug. 1–2.*	1	Pole	3½															
		1	do	3½															
		1	Meter	6															
		1	do	10															
		1	do	16															
S 65	0.3 mile S. 30° W. of Adams Point, Warren R. (41°42.7′ N., 71°17.8′ W.), July 28–29.	1	Pole	7	Degrees	33	38	180	187	210	241	289	289		14	27	14	20	NE.
		1	do	7	Knots	0.27	0.07	0.30	0.30	0.22	0.07	0.07	0.04	0.00	0.18	0.33	0.37	0.30	0.04
		1	Meter	4	do	0.27	0.11	0.30	0.26	0.22	0.18	0.11	0.15	0.11	0.18	0.41	0.41	0.33	
		1	do	10	do	0.27	0.07	0.30	0.30	0.30	0.15	0.07	0.07	0.18	0.26	0.30	0.33	0.33	
		1	do	16	do	0.24	0.18	0.41	0.33	0.22	0.11	0.04	0.07	0.15	0.18	0.26	0.37	0.26	
S 66	0.3 mile S. 5° W. of Adams Point, Warren R. (41°42.6′ N., 71°17.7′ W.), July 28–29.	1	Pole	3½	Degrees	17	13	173	188	187	196	202	147	4	11	12	12	19	S.
		1	do	3½	Knots	0.35	0.15	0.30	0.63	0.59	0.37	0.15	0.04	0.11	0.22	0.26	0.37	0.37	0.05
		1	Meter	2	do	0.35	0.15	0.44	0.70	0.70	0.44	0.26	0.11	0.18	0.30	0.37	0.48	0.37	
		1	do	8	do	0.30	0.11	0.37	0.74	0.63	0.52	0.22	0.07	0.15	0.18	0.33	0.44	0.41	
S 67	0.3 mile S. 15° E. of south end, Little Island, Warren R. (41°43.7′ N., 71°17.3′ W.), July 28–29.	1	Pole	3½	Degrees	358	342	164	178	174	168	160	179	23	13	0	0	3	S.
		1	do	3½	Knots	0.79	0.41	0.63	0.89	0.92	0.63	0.48	0.15	0.07	0.30	0.56	0.85	0.96	0.03
		1	Meter	6	do	0.94	0.52	0.74	0.92	0.92	0.81	0.59	0.26	0.22	0.48	0.70	1.04	0.96	
		1	do	12	do	0.87	0.44	0.63	0.78	0.78	0.63	0.44	0.30	0.22	0.30	0.70	0.85	0.85	
S 68	0.8 mile N. 77° W. of Castle Hill Light (41°27.9′ N., 71°22.9′ W.), June 23–24.	1	Pole	7	Degrees	139	195	237	236	264	267	316	303	51	30	34	15	63	S.
		1	do	7	Knots	0.15	0.34	0.63	0.92	0.82	0.15	0.19	0.10	0.10	0.24	0.26	0.24	0.19	0.14
		1	Meter	15	do	0.29	0.29	0.53	0.68	0.48	0.44	0.34	0.39	0.39	0.39	0.48	0.39	0.39	
		1	do	37	do	0.24	0.48	0.53	0.63	0.39	0.44	0.44	0.39	0.44	0.48	0.61	0.44	0.39	
		1	do	59	do	0.29	0.44	0.53	0.44	0.44	0.39	0.44	0.48	0.53	0.53	0.61	0.53	0.29	
S 69	0.3 mile N. 65° W. of Castle Hill Light (41°27.9′ N., 71°22.2′ W.), June 23–24.	1	Pole	3¼	Degrees	243	220	241	248	240	230	254		72	56	65	36	272	SW.
		1	do	3¼	Knots	0.10	0.24	1.12	1.40	1.40	1.02	0.48	0.00	0.10	0.39	0.55	0.58	0.39	0.37
		1	Meter	24	do	0.39	0.48	0.73	1.21	1.26	1.07	0.68	0.53	0.58	0.68	0.94	0.87	0.48	
		1	do	60	do	0.39	0.29	0.58	0.92	0.78	0.68	0.48	0.48	0.63	0.78	0.80	0.82	0.48	
		1	do	96	do	0.39	0.29	0.63	0.73	0.53	0.48	0.39	0.58	0.73	0.68	0.80	0.53	0.58	
S 70	0.2 mile north of Castle Hill Light (41°27.9′ N., 71°21.8′ W.), June 23–24.	1	Pole	7	Degrees	238	214	219	222	214	222	214		35	42	44	53	223	SW.
		1	do	7	Knots	0.15	0.92	1.21	1.36	1.12	0.73	0.29	0.00	0.97	0.92	0.97	0.58	0.29	0.22
		1	Meter	20	do	0.34	0.68	0.92	1.26	1.46	0.39	0.24	0.34	0.69	0.81	0.97	0.82	0.39	
		1	do	50	do	0.34	0.39	0.82	0.87	1.55	0.48	0.48	0.63	0.63	0.97	1.04	0.87	0.48	
		1	do	80	do	0.29	0.29	0.68	0.82	1.36	0.58	0.48	0.63	0.68	0.90	1.04	0.92	0.58	
S 71	0.2 mile N. 70° W. of southwest point, Conanicut Island (41°28.5′ N., 71°22.8′ W.), June 24–25.	1	Pole	7	Degrees		98	86		131			64	64	136	110	146	163	S.
		1	do	7	Knots	0.00	0.06	0.13	0.00	0.04	0.00	0.00	0.18	0.18	0.13	0.04	0.26	0.03	0.03
		1	Meter	9	do	0.15	0.20	0.31	0.31	0.26	0.26	0.26	0.31	0.35	0.31	0.31	0.26	0.47	
		1	do	22	do	0.24	0.24	0.26	0.31	0.26	0.31	0.26	0.35	0.35	0.26	0.26	0.31	0.35	
		1	do	35	do	0.15	0.18	0.26	0.31	0.35	0.31	0.31	0.31	0.31	0.35	0.26	0.35	0.33	
S 72	0.4 mile S. 56° W. of Fort Adams Light (41°28.7′ N., 71°20.7′ W.), June 24–25.	1	Pole	3¼	Degrees	71	157	171	204	198	150	60	61	26	32	34	35	54	NE.
		1	do	3¼	Knots	0.15	0.29	0.48	0.84	0.57	0.13	0.09	0.26	0.35	0.53	0.53	0.40	0.31	0.02
		1	Meter	22	do	0.33	0.41	0.79	1.01	0.62	0.22	0.13	0.18	0.44	0.66	0.75	0.75	0.31	
		1	do	54	do	0.24	0.44	0.92	0.88	0.53	0.13	0.09	0.18	0.48	0.62	1.06	0.62	0.35	
		1	do	86	do	0.26	0.38	0.79	0.97	0.40	0.13	0.13	0.26	0.44	0.75	0.83	0.70	0.40	
S 73	0.7 mile S. 74° W. of Fort Adams Light (41°28.7′ N., 71°21.1′ W.), June 24–25.	1	Pole	7	Degrees		225	222	233	212	208	31	14	48	54	47	46	87	SW.
		1	do	7	Knots	0.00	0.35	1.28	1.50	1.14	0.57	0.09	0.18	0.48	0.88	1.14	1.14	0.38	0.04
		1	Meter	20	do	0.33	0.66	1.45	1.45	1.32	0.62	0.26	0.57	0.62	0.97	1.19	1.14	0.55	
		1	do	50	do	0.38	0.66	1.41	1.45	1.41	0.53	0.26	0.66	0.88	0.97	1.19	1.19	0.88	
		1	do	80	do	0.47	0.70	1.32	1.45	1.28	0.53	0.26	0.53	0.88	0.97	1.06	1.10	0.62	

See footnotes at end of table.

Station	Observer, location, and date	Observations: Period	Observations: Method	Observations: Depth	True directions and velocities: Units	Hours after high water: 0	1	2	3	4	5	6	7	8	9	10	11	12	Nontidal current[1]
	J. C. SAMMONS, 1930—Continued	*Days*		*Feet*															
S 74[4]	0.2 mile S. 43° E. of Fort Adams Light (41°28.7′ N., 71°20.1′ W.), July 15–16.	1	Pole	3½	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
		1	...do...	3½	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
		1	Meter	4	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
		1	...do...	10	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
		1	...do...	16	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
S 75	0.2 mile S. 65° W. of South Light, Goat Island (41°28.9′ N., 71°19.8′ W.), July 15–16.	1	Pole	3¼	Degrees	297	322	354	24	------	65	97	112	137	146	320	113	225	SE.
		1	...do...	3¼	Knots	0.09	0.25	0.25	0.19	0.13	0.25	0.19	0.51	0.32	0.13	0.06	0.06	0.19	0.02
		1	Meter	7	...do...	0.34	0.32	0.25	0.32	0.19	0.19	0.25	0.38	0.32	0.19	0.13	0.25	0.25	------
		1	...do...	18	...do...	0.25	0.25	0.25	0.19	0.19	0.19	0.19	0.38	0.32	0.25	0.25	0.25	0.38	------
		1	...do...	30	...do...	0.29	0.19	0.25	0.06	0.19	0.19	0.25	0.38	0.38	0.19	0.25	0.25	0.25	------
S 76	0.1 mile N. 73° E. of South Light, Goat Island (41°29.0′ N., 71°19.5′ W.), July 14–15.	1	Pole	3¼	Degrees	80	217	246	245	212	120	81	121	160	165	182	290	141	S
		1	...do...	3¼	Knots	0.43	0.25	0.68	0.37	0.37	0.31	0.19	0.25	0.19	0.43	0.31	0.21	0.12	0.15
		1	Meter	4	...do...	0.43	0.68	0.74	0.50	0.50	0.43	0.43	0.31	0.31	0.31	0.37	0.33	0.37	------
		1	...do...	9	...do...	0.43	0.56	0.50	0.43	0.56	0.50	0.43	0.31	0.37	0.25	0.25	0.46	0.25	------
		1	...do...	14	...do...	0.43	0.50	0.62	0.43	0.37	0.37	0.43	0.43	0.37	0.31	0.31	0.33	0.25	------
S 77	0.3 mile S. 30° E. of North Light, Goat Island (41°29.4′ N., 71°19.5′ W.), July 14–15.	1	Pole	7	Degrees	131	124	144	168	355	14	------	331	------	------	------	------	155	S.
		1	...do...	7	Knots	0.12	0.37	0.43	0.43	0.06	0.19	0.00	0.25	0.00	0.00	0.00	0.00	0.12	0.05
		1	Meter	5	...do...	0.31	0.43	0.62	0.56	0.50	0.25	0.37	0.37	0.25	0.25	0.06	0.29	0.25	------
		1	...do...	11	...do...	0.31	0.50	0.62	0.56	0.37	0.25	0.25	0.37	0.31	0.25	0.12	0.33	0.25	------
		1	...do...	18	...do...	0.43	0.50	0.56	0.50	0.31	0.19	0.12	0.25	0.19	0.12	0.19	0.33	0.25	------
S 78	0.3 mile N. 60° W. of North Light, Goat Island (41°29.7′ N., 71°20.0′ W.), July 14–15.	1	Pole	3½	Degrees	6	47	190	194	185	150	132	------	31	26	------	30	25	N.
		1	...do...	3½	Knots	0.62	0.06	0.19	0.31	0.62	0.50	0.25	0.00	0.37	0.25	0.00	0.25	0.37	0.01
		1	Meter	10	...do...	0.56	0.56	0.74	0.62	0.50	0.74	0.56	0.50	0.62	0.62	0.37	0.58	0.37	------
		1	...do...	25	...do...	0.43	0.37	0.62	0.62	0.50	0.50	0.50	0.56	0.43	0.56	0.62	0.46	0.37	------
		1	...do...	40	...do...	0.31	0.56	0.62	0.50	0.50	0.50	0.62	0.37	0.50	0.43	0.37	0.33	0.37	------
S 79	0.1 mile N. 22° W. of Rose Island Light (41°29.8′ N., 71°20.6′ W.), June 25–27.	1½	Pole	7	Degrees	177	148	176	180	183	170	178	1	40	19	219	204	99	S.
		1½	...do...	7	Knots	0.08	0.24	0.83	0.59	0.49	0.54	0.11	0.02	0.02	0.06	0.14	0.49	0.04	0.28
		1½	Meter	10	...do...	0.28	0.20	0.87	0.70	0.57	0.54	0.32	0.24	0.19	0.19	0.24	0.59	0.28	------
		1½	...do...	25	...do...	0.32	0.24	0.57	0.65	0.49	0.40	0.19	0.19	0.19	0.24	0.32	0.54	0.28	------
		1½	...do...	40	...do...	0.36	0.32	0.43	0.46	0.38	0.27	0.22	0.14	0.11	0.24	0.38	0.43	0.28	------
S 80	0.3 mile N. 70° W, of Rose Island Light (41°29.8′ N., 71°21.0′ W.), June 25–27.	1½	Pole	3¼	Degrees	329	180	172	181	180	166	166	308	351	6	7	3	6	S.
		1½	...do...	3¼	Knots	0.46	0.20	0.69	0.89	0.87	0.38	0.24	0.30	0.19	0.30	0.46	0.65	0.65	0.07
		1½	Meter	28	...do...	0.79	0.36	0.73	0.95	0.83	0.59	0.27	0.35	0.43	0.59	0.95	1.08	0.94	------
		1½	...do...	69	...do...	0.75	0.36	0.57	0.83	0.79	0.57	0.24	0.43	0.49	0.81	1.16	1.11	0.97	------
		1½	...do...	110	...do...	0.73	0.57	0.49	0.71	0.65	0.46	0.16	0.27	0.35	0.62	0.92	0.89	0.89	------
S 81	0.8 mile N. 76° W. of Rose Island Light (41°29.9′ N., 71°21.7′ W.), June 25–27.	1½	Pole	7	Degrees	207	270	194	216	209	195	62	44	46	33	36	227	225	S.
		1½	...do...	7	Knots	0.43	0.57	0.70	0.65	0.57	0.16	0.14	0.35	0.24	0.22	0.08	0.03	0.36	0.25
		1½	Meter	12	...do...	0.40	0.40	0.65	0.32	0.30	0.08	0.22	0.35	0.30	0.24	0.22	0.19	0.49	------
		1½	...do...	30	...do...	0.43	0.24	0.45	0.20	0.16	0.08	0.24	0.27	0.24	0.19	0.19	0.24	0.45	------
		1½	...do...	48	...do...	0.32	0.20	0.28	0.08	0.16	0.22	0.14	0.22	0.27	0.22	0.22	0.24	0.36	------
S 82	0.1 mile S. 70° W. of Gull Rock Light (41°30.1′ N., 71°20.2′ W.), July 15–16.	1	Pole	7	Degrees	354	183	182	174	170	155	167	356	354	342	348	348	310	S.
		1	...do...	7	Knots	0.22	0.32	0.70	1.08	1.08	0.64	0.06	0.44	0.51	0.32	0.44	0.64	0.51	0.07
		1	Meter	9	...do...	0.42	0.64	0.70	1.08	1.14	0.70	0.25	0.44	0.64	0.51	0.57	0.57	0.51	------
		1	...do...	22	...do...	0.42	0.32	0.57	0.89	0.83	0.70	0.13	0.57	0.57	0.25	0.44	0.57	0.51	------
		1	...do...	36	...do...	0.38	0.19	0.51	0.64	0.64	0.32	0.25	0.51	0.38	0.13	0.25	0.38	0.44	------
S 83	0.1 mile N. 50° E. of Gull Rock Light (41°30.2′ N., 71°19.9′ W.), July 15–16.	1	Pole	7	Degrees	220	160	164	165	152	157	342	341	321	335	336	332	326	------
		1	...do...	7	Knots	0.13	0.25	0.89	1.14	0.44	0.06	0.38	0.70	0.32	0.19	0.38	0.44	0.25	0.00
		1	Meter	10	...do...	0.34	0.38	0.95	1.14	0.76	0.25	0.44	0.76	0.44	0.19	0.38	0.38	0.51	------
		1	...do...	25	...do...	0.29	0.19	0.51	0.95	0.57	0.19	0.44	0.76	0.38	0.13	0.38	0.25	0.76	------
		1	...do...	40	...do...	0.38	0.19	0.51	0.83	0.51	0.19	0.44	0.51	0.25	0.19	0.25	0.25	0.64	------
S 84	0.2 mile N. 65° W. of Bishop Rock (41°31.1′ N., 71°20.0′ W.), June 30–July 1.	1	Pole	7	Degrees	336	207	218	188	184	174	33	10	354	14	21	18	15	S.
		1	...do...	7	Knots	0.14	0.41	1.08	1.10	0.69	0.28	0.09	0.23	0.28	0.32	0.46	0.46	0.46	0.13
		1	Meter	12	...do...	0.23	0.51	1.04	1.10	0.74	0.37	0.18	0.37	0.32	0.32	0.46	0.51	0.37	------
		1	...do...	30	...do...	0.14	0.60	1.04	1.20	0.74	0.28	0.23	0.28	0.18	0.37	0.37	0.37	0.37	------
		1	...do...	46	...do...	0.18	0.60	0.83	1.10	0.74	0.23	0.18	0.18	0.28	0.23	0.32	0.32	0.18	------
S 85	0.5 mile north of Taylors Point (41°31.1′ N., 71°21.6′ W.), June 30–July 1.	1	Pole	3¼	Degrees	270	187	10	29	35	39	46	12	43	16	47	34	246	N.
		1	...do...	3¼	Knots	0.05	0.32	0.09	0.28	0.28	0.23	0.55	0.41	0.28	0.37	0.37	0.09	0.37	0.20
		1	Meter	5	...do...	0.28	0.41	0.23	0.30	0.41	0.46	0.55	0.41	0.28	0.41	0.37	0.23	0.28	------
		1	...do...	12	...do...	0.46	0.46	0.37	0.30	0.32	0.46	0.55	0.32	0.37	0.41	0.37	0.14	0.37	------
		1	...do...	20	...do...	0.37	0.46	0.32	0.40	0.28	0.55	0.41	0.37	0.32	0.37	0.32	0.28	0.37	------
S 86	0.6 mile S. 28° E. of Gould Island Light (41°31.5′ N., 71°20.2′ W.), June 30–July 1.	1	Pole	7	Degrees	11	306	250	194	184	202	98	56	42	44	42	19	17	N.
		1	...do...	7	Knots	0.23	0.05	0.60	0.52	0.64	0.37	0.23	0.41	0.32	0.37	0.51	0.46	0.55	0.01
		1	Meter	22	...do...	0.23	0.23	0.60	0.74	0.87	0.37	0.23	0.28	0.23	0.46	0.55	0.51	0.46	------
		1	...do...	54	...do...	0.32	0.18	0.60	0.80	0.83	0.37	0.23	0.23	0.28	0.46	0.69	0.69	0.64	------
		1	...do...	86	...do...	0.28	0.18	0.55	0.64	0.60	0.41	0.28	0.37	0.18	0.46	0.55	0.64	0.64	------
S 87	0.3 mile S. 24° W. of north end of Gould Island (41°32.0′ N., 71°20.9′ W.), July 16–17.	1	Pole	7	Degrees	12	209	186	168	184	134	------	358	8	356	338	348	349	S.
		1	...do...	7	Knots	0.10	0.04	0.54	0.75	0.68	0.07	0.00	0.27	0.34	0.20	0.14	0.14	0.14	0.07
		1	Meter	11	...do...	0.31	0.23	0.75	1.02	0.88	0.54	0.20	0.34	0.41	0.41	0.27	0.34	0.41	------
		1	...do...	28	...do...	0.31	0.37	0.68	0.75	0.54	0.41	0.41	0.48	0.54	0.34	0.41	0.27	0.27	------
		1	...do...	44	...do...	0.37	0.37	0.61	0.48	0.41	0.27	0.20	0.20	0.54	0.27	0.20	0.27	0.14	------
S 88	0.2 mile east of Fowlers Rocks (41°32.0′ N., 71°21.6′ W.), July 16–17.	1	Pole	7	Degrees	14	126	157	171	162	192	146	75	353	358	4	11	17	S.
		1	...do...	7	Knots	0.10	0.18	0.48	0.75	0.68	0.48	0.07	0.07	0.20	0.41	0.41	0.20	0.14	0.06
		1	Meter	14	...do...	0.27	0.18	0.54	0.82	0.82	0.54	0.27	0.27	0.27	0.48	0.48	0.34	0.27	------
		1	...do...	36	...do...	0.27	0.27	0.61	0.75	0.68	0.48	0.27	0.48	0.27	0.54	0.54	0.48	0.27	------
		1	...do...	58	...do...	0.31	0.31	0.54	0.54	0.82	0.34	0.41	0.48	0.41	0.14	0.14	0.34	0.54	------
S 89	0.2 mile east of Coddington Point (41°31.4′ N., 71°19.2′ W.), July 16–17.	1	Pole	3¼	Degrees	13	340	318	0	56	94	16	19	352	328	21	48	------	NW.
		1	...do...	3¼	Knots	0.04	0.18	0.34	0.14	0.20	0.27	0.20	0.27	0.27	0.34	0.14	0.07	0.00	0.09
		1	Meter	6	...do...	0.37	0.31	0.27	0.34	0.34	0.27	0.20	0.27	0.34	0.20	0.27	0.34	0.00	------
		1	...do...	16	...do...	0.37	0.31	0.34	0.34	0.41	0.27	0.27	0.34	0.14	0.27	0.20	0.20	0.00	------
		1	...do...	26	...do...	0.27	0.23	0.41	0.14	0.27	0.27	0.34	0.20	0.07	0.27	0.27	0.34	0.00	------
S 90	1.1 mile N. 83° E. of Gould Island Light (41°32.2′ N., 71°19.1′ W.), July 16–17.	1	Pole	3½	Degrees	149	196	186	193	219	34	26	14	28	36	12	12	117	NE.
		1	...do...	3½	Knots	0.04	0.41	0.48	0.41	0.41	0.41	0.34	0.27	0.20	0.34	0.41	0.27	0.27	0.05
		1	Meter	7	...do...	0.45	0.54	0.75	0.61	0.41	0.54	0.61	0.61	0.34	0.48	0.48	0.54	0.41	------
		1	...do...	18	...do...	0.37	0.45	0.68	0.68	0.41	0.61	0.82	0.48	0.48	0.27	0.41	0.41	0.54	------
		1	...do...	29	...do...	0.31	0.37	0.34	0.41	0.34	0.61	0.41	0.27	0.34	0.41	0.34	0.41	0.27	------

See footnotes at end of table.

TABLE 1.—*Current Data, Narragansett Bay—Continued*

Station	Observer, location, and date	Observations: Period	Observations: Method	Observations: Depth	True directions and velocities: Units	Hours after high water: 0	1	2	3	4	5	6	7	8	9	10	11	12	Non-tidal current [1]
	J. C. SAMMONS, 1930—Continued	*Days*		*Feet*															
S 91	0.6 mile S., 79° E. of Halfway Rock Beacon (41°33.7′ N., 71°19.2′ W.), July 1-2.	1	Pole	7	Degrees	122	220	212	219	221	216	201	222	197	259	331	15	22	S.
		1	do	7	Knots	0.10	0.20	0.50	0.86	0.96	1.01	0.86	0.45	0.15	0.20	0.25	0.30	0.30	0.34
		1	Meter	20	do	0.15	0.25	0.50	0.91	1.11	0.61	0.61	0.45	0.30	0.30	0.35	0.50	0.35	------
		1	do	50	do	0.40	0.20	0.30	0.61	0.50	0.35	0.35	0.35	0.35	0.30	0.40	0.56	0.50	------
		1	do	80	do	0.40	0.20	0.35	0.56	0.25	0.40	0.61	0.50	0.40	0.30	0.56	0.66	0.61	------
S 92	0.3 mile N., 88° W. of Halfway Rock Beacon (41°33.8′ N., 71°20.4′ W.) July 1-3.	2	Pole	7	Degrees	323	227	214	202	211	209	42	19	54	28	4	340	317	S.
		2	do	7	Knots	0.05	0.42	0.52	0.60	0.50	0.15	0.15	0.47	0.31	0.29	0.29	0.33	0.13	0.01
		2	Meter	7	do	0.21	0.47	0.57	0.57	0.56	0.23	0.31	0.47	0.40	0.40	0.40	0.40	0.23	------
		2	do	17	do	0.16	0.31	0.50	0.68	0.54	0.23	0.21	0.44	0.36	0.40	0.42	0.40	0.19	------
		2	do	27	do	0.19	0.29	0.52	0.54	0.48	0.17	0.31	0.26	0.21	0.21	0.40	0.40	0.31	------
S 93	0.6 mile S., 60° E. of North Point Light (41°34.1′ N., 71°21.6′ W.), July 1-2.	1	Pole	3¼	Degrees	27	205	166	------	151	163	352	353	344	348	353	352	4	N.
		1	do	3¼	Knots	0.05	0.15	0.40	0.61	0.56	0.10	0.10	0.20	0.30	0.40	0.81	0.66	0.35	0.08
		1	Meter	9	do	0.25	0.35	0.66	0.66	0.76	0.27	0.20	0.25	0.30	0.50	0.81	0.81	0.40	------
		1	do	22	do	0.30	0.40	0.40	0.40	0.61	0.27	0.20	0.40	0.30	0.56	0.66	0.50	0.20	------
		1	do	36	do	0.15	0.30	0.35	0.40	0.30	0.17	0.35	0.35	0.40	0.50	0.50	0.35	0.20	------
S 94	1.0 mile N., 45° W. of Halfway Rock Beacon (41°34.5′ N., 71°20.9′ W.), July 2-3.	1	Pole	3¼	Degrees	234	207	188	192	184	172	122	67	23	76	23	1	63	S.
		1	do	3¼	Knots	0.10	0.52	0.58	0.68	0.58	0.37	0.03	0.21	0.16	0.21	0.21	0.26	0.05	0.11
		1	Meter	6	do	0.37	0.37	0.47	0.58	0.58	0.47	0.24	0.32	0.37	0.21	0.32	0.42	0.32	------
		1	do	16	do	0.37	0.32	0.32	0.37	0.42	0.42	0.21	0.26	0.32	0.47	0.58	0.58	0.37	------
		1	do	25	do	0.37	0.37	0.32	0.37	0.21	0.32	0.28	0.42	0.37	0.42	0.42	0.37	0.32	------
S 95	1.0 mile N., 6° W. of Halfway Rock Beacon (41°34.8′ N., 71°20.1′ W.), July 2-3.	1	Pole	7	Degrees	173	169	160	157	158	160	------	58	------	------	331	356	303	S.
		1	do	7	Knots	0.05	0.16	0.37	0.42	0.37	0.21	0.00	0.05	0.00	0.00	0.05	0.21	0.05	0.08
		1	Meter	5	do	0.21	0.21	0.37	0.58	0.47	0.21	0.21	0.21	0.16	0.10	0.10	0.26	0.21	------
		1	do	14	do	0.21	0.26	0.26	0.47	0.21	0.10	0.21	0.16	0.21	0.10	0.21	0.32	0.16	------
		1	do	23	do	0.21	0.16	0.26	0.26	0.10	0.10	0.26	0.26	0.16	0.16	0.21	0.37	0.26	------
S 96	On Melville Range, 0.6 mile from Front Light (41°34.5′ N., 71°17.8′ W.), July 18-19.	1	Pole	7	Degrees	56	229	243	260	228	270	35	44	40	40	34	34	40	NE.
		1	do	7	Knots	0.49	0.07	0.21	0.28	0.42	0.14	0.56	0.77	0.42	0.56	0.56	0.70	0.56	0.19
		1	Meter	9	do	0.56	0.28	0.42	0.56	0.56	0.32	0.56	0.84	0.56	0.56	0.56	0.84	0.70	------
		1	do	23	do	0.35	0.42	0.70	0.77	0.42	0.32	0.42	0.70	0.42	0.21	0.42	0.63	0.28	------
		1	do	36	do	0.28	0.49	0.84	0.70	0.35	0.32	0.35	0.21	0.07	0.21	0.28	0.35	0.42	------
S 97	0.3 mile N., 78° W. of north end, Dyer Island (41°35.2′ N., 71°18.5′ W.), July 18-19.	1	Pole	7	Degrees	26	326	202	209	193	223	0	336	22	32	16	20	16	NE.
		1	do	7	Knots	0.42	0.07	0.49	0.84	0.70	0.74	0.28	0.28	0.49	0.63	0.56	0.63	0.42	0.05
		1	Meter	23	do	0.35	0.21	0.91	1.05	0.98	1.02	0.42	0.21	0.28	0.35	0.42	0.49	0.42	------
		1	do	57	do	0.28	0.14	0.84	1.33	0.91	0.60	0.42	0.56	0.49	0.42	0.42	0.70	0.42	------
		1	do	91	do	0.35	0.14	0.63	0.70	0.42	0.66	0.70	0.70	0.49	0.42	0.77	0.70	0.70	------
S "S"	*0.6 mile S., 27° E. of Sandy Point Light (41°35.8′ N., 71°17.9′ W.), July 18-19.*	*1*	Pole	*3¼*	Degrees	*6*	*34*	*187*	*232*	*230*	*278*	358	34	8	46	13	0	358	N.
		1	do	3¼	Knots	0.56	0.35	0.42	0.84	0.84	0.52	0.42	0.42	0.49	0.77	0.77	0.77	0.42	0.13
		1	Meter	17	do	0.42	0.42	0.77	0.77	0.91	0.60	0.35	0.49	0.28	0.56	0.42	0.56	0.28	------
		1	do	44	do	0.56	0.42	0.70	0.91	0.77	0.46	0.49	0.49	0.35	0.28	0.35	0.35	0.56	------
		1	do	70	do	0.49	0.42	0.42	0.49	0.35	0.52	0.56	0.49	0.21	0.35	0.28	0.56	0.00	------
S 98	0.8 mile S. 27° W. of Hog Island Shoal Light (41°37.2′ N, 71°16.9′ W.), Sept. 16-17.	1	Pole	7	Degrees	354	217	214	228	225	229	14	14	352	24	40	44	26	NE.
		1	do	7	Knots	0.32	0.27	0.82	0.89	0.82	0.21	0.34	0.48	0.34	0.41	0.55	0.68	0.68	0.02
		1	Meter	7	do	0.41	0.41	1.03	0.96	1.03	0.62	0.41	0.62	0.41	0.48	0.75	0.75	0.68	------
		1	do	18	do	0.32	0.45	0.82	0.89	0.68	0.55	0.48	0.68	0.48	0.55	0.75	0.68	0.27	------
		1	do	29	do	0.32	0.59	0.62	0.75	0.68	0.41	0.27	0.55	0.41	0.34	0.75	0.55	0.27	------
S 99	0.7 mile S. 64° W. of Hog Island Shoal Light (41°37.6′ N., 71°17.2′ W.), Aug. 8-9.	1	Pole	3¼	Degrees	------	232	244	204	147	99	96	88	------	356	347	306	289	SW.
		1	do	3¼	Knots	0.00	0.22	0.87	0.60	0.38	0.11	0.27	0.27	0.00	0.05	0.27	0.32	0.16	0.06
		1	Meter	7	do	0.05	0.11	0.54	0.43	0.38	0.16	0.27	0.22	0.32	0.43	0.38	0.32	0.16	------
		1	do	16	do	0.16	0.11	0.38	0.27	0.00	0.05	0.11	0.16	0.22	0.43	0.49	0.51	0.27	------
		1	do	26	do	0.11	0.11	0.16	0.11	0.00	0.00	0.05	0.16	0.32	0.43	0.49	0.43	0.27	------
S 100	0.6 mile N., 12° W. of Homestead Wharf (41°37.7′ N., 71°18.4′ W.), Aug. 8-9.	1	Pole	7	Degrees	126	141	136	148	145	158	------	323	356	------	306	99	185	SE.
		1	do	7	Knots	0.22	0.54	0.59	0.65	0.43	0.32	0.00	0.16	0.05	0.00	0.05	0.11	0.16	0.18
		1	Meter	4	do	0.40	0.43	0.59	0.65	0.54	0.38	0.16	0.32	0.22	0.05	0.22	0.16	0.27	------
		1	do	14	do	0.29	0.49	0.65	0.59	0.43	0.22	0.16	0.22	0.05	0.05	0.22	0.11	0.22	------
S 101	0.6 mile S., 61° W. of southwest point, Hog Island (41°37.9′ N., 71°17.8′ W.), Aug. 8-9, Sept. 16-17.	2	Pole	7	Degrees	358	52	153	144	139	144	76	18	16	357	352	355	350	NW.
		2	do	7	Knots	0.24	0.02	0.06	0.30	0.39	0.22	0.10	0.22	0.24	0.30	0.42	0.46	0.33	0.05
		2	Meter	10	do	0.34	0.24	0.24	0.42	0.51	0.30	0.12	0.30	0.36	0.39	0.46	0.58	0.40	------
		2	do	24	do	0.29	0.19	0.27	0.24	0.34	0.15	0.22	0.34	0.36	0.24	0.36	0.34	0.40	------
		2	do	36	do	0.19	0.24	0.39	0.30	0.30	0.18	0.21	0.30	0.30	0.27	0.30	0.24	0.24	------
S 102	0.1 mile N., 70° E. of Popasquash Point (41°39.0′ N., 71°17.9′ W.), July 17-18.	1	Pole	3½	Degrees	37	194	208	202	200	204	------	39	------	------	7	6	22	S.
		1	do	3½	Knots	0.07	0.07	0.20	0.31	0.27	0.27	0.00	0.14	0.00	0.00	0.14	0.27	0.14	0.02
		1	Meter	3	do	0.27	0.34	0.34	0.45	0.54	0.40	0.34	0.34	0.27	0.14	0.20	0.34	0.34	------
		1	do	11	do	0.20	0.27	0.47	0.50	0.47	0.47	0.40	0.14	0.20	0.07	0.20	0.27	0.34	------
S 103	0.4 mile S. 35° W. of Castle Island Light (41°38.9′ N., 71°17.5′ W.), July 17-18	1	Pole	7	Degrees	16	19	191	230	191	156	------	47	38	15	16	18	12	N.
		1	do	7	Knots	0.27	0.14	0.14	0.14	0.20	0.14	0.00	0.14	0.20	0.27	0.27	0.34	0.40	0.06
		1	Meter	6	do	0.40	0.20	0.20	0.31	0.20	0.27	0.34	0.34	0.20	0.27	0.34	0.54	0.47	------
		1	do	14	do	0.34	0.20	0.27	0.27	0.34	0.40	0.27	0.20	0.27	0.27	0.34	0.40	0.34	------
		1	do	22	do	0.20	0.20	0.20	0.36	0.34	0.27	0.40	0.34	0.27	0.20	0.20	0.27	0.34	------
S 104	0.1 mile N. 75° W. of spar "4", Bristol Harbor (41°40.4′ N., 71°17.1′ W.), July 17-18.	1	Pole	3¼	Degrees	32	333	------	36	353	347	65	50	71	------	------	313	0	N.
		1	do	3¼	Knots	0.20	0.34	0.00	0.27	0.20	0.14	0.14	0.07	0.07	0.00	0.00	0.07	0.27	0.09
		1	Meter	4	do	0.40	0.34	0.20	0.23	0.40	0.27	0.14	0.14	0.00	0.07	0.20	0.20	0.27	------
		1	do	14	do	0.27	0.27	0.20	0.23	0.34	0.20	0.20	0.20	0.07	0.20	0.27	0.14	0.27	------
S 105	0.7 mile N. 42° W. of Musselbed Shoal Light (41°38.7′ N., 71°16.3′ W.), Aug. 7-8.	1	Pole	3½	Degrees	178	183	248	------	92	4	355	9	71	185	184	152	161	S.
		1	do	3½	Knots	0.40	0.23	0.17	0.00	0.11	0.11	0.11	0.23	0.11	0.17	0.26	0.45	0.56	0.07
		1	Meter	6	do	0.45	0.28	0.23	0.23	0.17	0.40	0.23	0.23	0.28	0.34	0.53	0.45	0.45	------
		1	do	13	do	0.45	0.23	0.17	0.06	0.28	0.51	0.23	0.23	0.23	0.34	0.53	0.51	0.56	------
		1	do	20	do	0.40	0.17	0.17	0.11	0.28	0.40	0.11	0.17	0.11	0.34	0.49	0.56	0.45	------
S 106	0.1 mile S. 24° E. of north Tower, Mount Hope Bridge (41°38.4′ N., 71°15.5′ W.), Aug. 7-8.	1	Pole	7	Degrees	67	216	234	230	231	240	225	34	47	36	47	44	65	SW.
		1	do	7	Knots	0.62	0.17	1.07	1.24	1.24	1.02	0.23	0.45	0.79	0.60	0.53	1.13	0.57	0.05
		1	Meter	16	do	0.73	0.40	0.90	1.24	1.36	1.19	0.23	0.68	0.96	0.51	0.82	1.13	0.79	------
		1	do	39	do	0.73	0.56	0.96	1.41	1.36	1.13	0.11	1.02	1.13	0.90	1.05	1.30	1.13	------
		1	do	62	do	0.51	0.51	0.90	1.30	1.24	0.96	0.28	0.90	1.13	1.07	0.94	1.19	1.13	------

See footnotes at end of table.

Station	Observer, location, and date	Observations			True directions and velocities														
		Period	Method	Depth	Units	Hours after high water													Nontidal current [1]
						0	1	2	3	4	5	6	7	8	9	10	11	12	
	J. C. SAMMONS, 1930—Continued	*Days*		*Feet*															
S 107	West Draw, Tiverton railroad bridge (41°38.3′ N., 71°12.9′ W.), Aug. 7–8	1	Pole	7	(1)	S.	S.	S.	S.	S.	N.	N.	N.	N.	N.	N.	N.	S.	N.
		1	do	7	Knots	1.36	2.43	1.75	2.09	1.07	1.41	2.77	[5] 1.24	[6] 0.11	[7] 1.30	1.44	0.90	1.13	0.01
		1	Meter	5	do	1.47	2.49	1.98	1.92	1.13	1.47	2.82	1.24	0.11	1.30	1.50	0.96	1.02	------
		1	do	13	do	1.41	2.43	1.81	2.03	1.13	1.47	2.88	1.30	0.17	1.41	1.44	1.02	1.13	------
		1	do	20	do	1.47	2.49	1.81	1.92	1.07	1.36	2.99	1.30	0.11	1.47	1.47	0.90	1.13	------
S 108	0.9 mile N. 41° E. of Common Fence Point (41°40.0′ N., 71°12.5′ W.), Aug. 6–7.	1	Pole	7	Degrees	168	222	218	214	210	201	52	39	84	39	32	46	21	SW.
		1	do	7	Knots	0.06	0.12	0.29	0.35	0.29	0.12	0.06	0.23	0.23	0.06	0.12	0.29	0.06	0.02
		1	Meter	4	do	0.23	0.23	0.29	0.29	0.35	0.23	0.12	0.23	0.35	0.35	0.41	0.35	0.23	------
		1	do	14	do	0.18	0.29	0.29	0.29	0.12	0.18	0.29	0.41	0.29	0.29	0.18	0.35	0.18	------
S 109	0.7 mile N. 18° W. of Common Fence Point (41°40.0′ N., 71°13.6′ W.), Aug. 6–7.	1	Pole	7	Degrees	44	30	229	202	234	218	142	50	77	58	33	40	36	NE.
		1	do	7	Knots	0.47	0.18	0.12	0.41	0.35	0.35	0.06	0.23	0.29	0.23	0.29	0.35	0.58	0.08
		1	Meter	6	do	0.53	0.23	0.23	0.53	0.53	0.41	0.06	0.18	0.41	0.41	0.35	0.47	0.53	------
		1	do	14	do	0.47	0.18	0.29	0.29	0.41	0.18	0.06	0.53	0.58	0.35	0.41	0.41	0.47	------
		1	do	22	do	0.23	0.12	0.29	0.23	0.18	0.12	0.18	0.29	0.35	0.23	0.29	0.35	0.29	------
S 110	The Narrows, Kickamuit River (41°41.9′ N., 71°14.7′ W.), Aug. 6–7	1	Pole	3¼	Degrees	2	178	183	186	192	186	16	356	3	0	358	354	0	N.
		1	do	3¼	Knots	0.53	0.35	1.23	1.87	2.11	1.29	0.82	1.11	0.94	0.58	1.05	1.70	1.17	0.05
		1	Meter	2	do	0.82	0.47	1.11	1.40	1.52	0.70	0.64	1.29	0.94	1.11	1.35	1.81	1.46	------
		1	do	10	do	0.76	0.35	1.29	1.40	1.52	0.76	0.58	1.29	1.35	1.11	1.35	1.70	1.17	------
S 111	0.3 mile N. 75° W. of Mattapoiset Rock (41°42.8′ N., 71°13.3′ W.), Aug. 5–6	1	Pole	7	Degrees	330	------	191	187	------	229	233	------	335	326	325	331	350	N.
		1	do	7	Knots	0.06	0.00	0.06	0.12	0.00	0.06	0.12	0.00	0.25	0.06	0.06	0.12	0.12	0.02
		1	Meter	4	do	0.12	0.12	0.19	0.25	0.25	0.19	0.25	0.21	0.25	0.31	0.31	0.19	0.25	------
		1	do	14	do	0.06	0.06	0.19	0.25	0.06	0.06	0.25	0.25	0.12	0.12	0.19	0.06	0.00	------
S 112	0.3 mile N. 38° W. of Brayton Point (41°42.6′ N., 71°11.9′ W.), Aug. 5–6	1	Pole	3¼	Degrees	------	33	------	------	------	------	131	35	105	106	------	------	65	------
		1	do	3¼	Knots	0.00	0.31	0.00	0.00	0.00	0.00	0.06	0.12	0.19	0.12	0.00	0.00	0.12	0.00
		1	Meter	3	do	0.00	0.12	0.06	0.06	0.12	0.12	0.12	0.29	0.19	0.25	0.19	0.06	0.12	------
		1	do	12	do	0.00	0.12	0.06	0.00	0.06	0.06	0.12	0.16	0.19	0.31	0.19	0.12	0.12	------
S 113	0.2 mile S. 70° E. of Borden Flats Light (41°42.2′ N., 71°10.3′ W.), Aug. 4–5	1	Pole	3¼	Degrees	86	234	227	224	212	232	------	0	35	100	46	40	80	SW.
		1	do	3¼	Knots	0.07	0.33	0.39	0.46	0.52	0.52	0.22	0.26	0.26	0.20	0.33	0.46	0.20	0.01
		1	Meter	5	do	0.33	0.52	0.79	0.79	0.92	0.72	0.52	0.52	0.46	0.39	0.52	0.79	0.46	------
		1	do	12	do	0.33	0.65	0.92	0.92	0.92	0.72	0.52	0.52	0.52	0.52	0.52	0.52	0.59	------
		1	do	20	do	0.39	0.52	0.79	0.65	0.59	0.52	0.69	0.52	0.52	0.46	0.39	0.65	0.46	------
S 114	0.2 mile N. 20° E. of Borden Flats Light (41°42.4′ N., 71°10.4′ W.), Aug. 4–5	1	Pole	7	Degrees	47	327	266	238	244	244	51	49	44	48	39	43	52	NE.
		1	do	7	Knots	0.20	0.20	0.33	0.52	0.39	0.33	0.30	0.52	0.46	0.33	0.33	0.59	0.39	0.09
		1	Meter	4	do	0.39	0.33	0.46	0.52	0.59	0.46	0.35	0.65	0.59	0.52	0.59	0.79	0.59	------
		1	do	14	do	0.26	0.39	0.52	0.33	0.33	0.33	0.43	0.52	0.39	0.33	0.59	0.65	0.26	------
S 115	*Off Shell Oil Co. dock, Steep Brook, Taunton River (41°44.1′ N., 71°08.6′ W.), Aug. 4–6*	2	Pole	7	Degrees	24	232	220	234	228	237	------	37	39	73	40	36	32	SW.
		2	do	7	Knots	0.51	0.38	0.67	0.87	0.79	0.51	0.00	0.49	0.2[illegible]	0.15	0.33	0.70	0.77	0.03
		2	Meter	6	do	0.38	0.22	0.70	0.96	0.92	0.74	0.20	0.51	0.38	0.19	0.28	0.64	0.68	------
		2	do	16	do	0.51	0.29	0.58	0.79	0.67	0.32	0.18	0.69	0.58	0.36	0.54	0.83	0.77	------
		2	do	26	do	0.36	0.22	0.45	0.74	0.64	0.26	0.23	0.61	0.58	0.28	0.45	0.77	0.64	------
S 116	0.2 mile east of Gould Island, Sakonnet River (41°36.9′ N., 71°12.9′ W.) Sept. 9–11.	1½	Pole	7	Degrees	------	195	177	------	------	347	359	10	351	17	14	------	------	N.
		1½	do	7	Knots	0.00	0.07	0.03	0.00	0.00	0.18	0.38	0.24	0.03	0.16	0.18	0.00	0.00	0.08
		1½	Meter	4	do	0.18	0.14	0.14	0.10	0.07	0.28	0.42	0.34	0.24	0.26	0.21	0.21	0.21	------
		1½	do	11	do	0.18	0.10	0.10	0.10	0.10	0.21	0.38	0.38	0.18	0.26	0.18	0.21	0.21	------
		1½	do	17	do	0.10	0.10	0.10	0.10	0.10	0.21	0.24	0.21	0.18	0.31	0.21	0.24	0.21	------
S 117	0.1 mile N. 80° W. of High Hill Point (41°32.9′ N., 71°13.2′ W.), Sept. 5–6.	1	Pole	3¼	Degrees	310	181	128	140	130	35	2	4	8	14	12	357	348	N.
		1	do	3¼	Knots	0.14	0.22	0.33	0.22	0.22	0.05	0.38	0.33	0.38	0.38	0.27	0.22	0.27	0.09
		1	Meter	5	do	0.29	0.38	0.49	0.49	0.38	0.44	0.44	0.44	0.44	0.44	0.38	0.22	0.38	------
		1	do	13	do	0.36	0.44	0.44	0.44	0.38	0.33	0.44	0.33	0.49	0.49	0.38	0.27	0.44	------
		1	do	21	do	0.36	0.54	0.44	0.44	0.27	0.33	0.44	0.33	0.33	0.27	0.33	0.27	0.38	------
S 118	0.3 mile S. 33° E. of Sandy Point, Sakonnet River (41°32.8′ N., 71°13.8′ W.), Sept. 5–6.	1	Pole	7	Degrees	194	168	160	168	140	150	------	------	8	352	32	344	334	S.
		1	do	7	Knots	0.08	0.22	0.44	0.49	0.49	0.27	0.00	0.00	0.33	0.38	0.38	0.22	0.05	0.06
		1	Meter	5	do	0.36	0.44	0.60	0.71	0.65	0.44	0.22	0.22	0.33	0.27	0.33	0.33	0.54	------
		1	do	13	do	0.33	0.33	0.49	0.60	0.60	0.38	0.22	0.16	0.27	0.38	0.49	0.22	0.44	------
		1	do	20	do	0.36	0.33	0.49	0.54	0.38	0.33	0.27	0.27	0.22	0.33	0.44	0.27	0.49	------
S 119	0.5 mile S. 38° E. of Flint Point (41°28.8′ N., 71°13.9′ W.), Sept. 2–3.	1	Pole	3¼	Degrees	76	120	134	115	48	30	33	16	41	30	13	355	71	N.
		1	do	3¼	Knots	0.58	0.44	0.15	0.15	0.22	0.22	0.15	0.22	0.34	0.29	0.51	0.29	0.73	0.12
		1	Meter	8	do	0.73	0.73	0.73	0.80	0.73	0.73	0.73	0.58	0.63	0.58	0.58	0.66	0.58	------
		1	do	21	do	0.73	0.66	0.80	0.73	0.73	0.66	0.66	0.66	0.63	0.44	0.51	0.58	0.73	------
		1	do	34	do	0.58	0.66	0.73	0.73	0.66	0.66	0.58	0.73	0.58	0.51	0.58	0.51	0.58	------
S 120	1.0 mile S. 83° E. of Flint Point, Sakonnet River (41°29.1′ N., 71°13.0′ W.), Sept. 2–4.	2	Pole	7	Degrees	81	142	148	144	150	145	138	138	38	18	17	7	87	S.
		2	do	7	Knots	0.21	0.34	0.52	0.34	0.25	0.14	0.14	0.03	0.03	0.05	0.21	0.21	0.27	0.07
		2	Meter	9	do	0.55	0.58	0.62	0.62	0.73	0.62	0.58	0.55	0.30	0.38	0.44	0.44	0.55	------
		2	do	22	do	0.55	0.52	0.55	0.62	0.55	0.62	0.62	0.58	0.30	0.44	0.52	0.44	0.59	------
		2	do	36	do	0.55	0.52	0.58	0.55	0.51	0.55	0.55	0.62	0.33	0.36	0.44	0.38	0.51	------
S 121	1.1 miles N. 9° W. of Breakwater Light, Sakonnet River (41°29.0′ N., 71°12.0′ W.), Sept. 2–3.	1	Pole	7	Degrees	32	144	140	119	118	39	------	------	343	334	25	336	------	S.
		1	do	7	Knots	0.07	0.15	0.15	0.22	0.29	0.07	0.00	0.00	0.10	0.07	0.15	0.07	0.00	0.02
		1	Meter	6	do	0.44	0.51	0.66	0.66	0.66	0.58	0.66	0.51	0.44	0.36	0.44	0.36	0.44	------
		1	do	15	do	0.51	0.44	0.44	0.44	0.36	0.51	0.51	0.51	0.34	0.29	0.29	0.36	0.58	------
		1	do	24	do	0.44	0.51	0.51	0.44	0.58	0.51	0.58	0.36	0.44	0.29	0.29	0.36	0.58	------
S 122	0.4 mile N. 8° W. of Cormorant Rock (41°28.0′ N., 71°15.0′ W.), Sept. 4–5.	1	Pole	3¼	Degrees	285	280	295	285	250	------	30	------	4	12	265	306	285	W.
		1	do	3¼	Knots	0.23	0.23	0.23	0.06	0.06	0.00	0.06	0.00	0.29	0.53	0.23	0.47	0.18	0.02
		1	Meter	9	do	0.41	0.41	0.53	0.53	0.53	0.47	0.53	0.53	0.41	0.53	0.58	0.53	0.41	------
		1	do	23	do	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.41	0.64	0.53	0.47	0.47	------
		1	do	37	do	0.35	0.41	0.41	0.47	0.47	0.47	0.53	0.41	0.41	0.53	0.58	0.29	0.35	------
S 123	0.1 mile west of Gould Island, Sakonnet River (41°36.9′ N., 71°13.4′ W.), Sept. 11–12.	1	Pole	7	Degrees	------	201	192	208	208	------	------	------	201	------	------	------	------	S.
		1	do	7	Knots	0.00	0.27	0.32	0.54	0.11	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.09
		1	Meter	10	do	0.32	0.37	0.54	0.80	0.32	0.37	0.27	0.32	0.27	0.21	0.16	0.27	0.27	------
		1	do	24	do	0.21	0.37	0.59	0.64	0.43	0.32	0.27	0.32	0.21	0.21	0.21	0.21	0.27	------
		1	do	38	do	0.32	0.37	0.54	0.59	0.32	0.37	0.21	0.27	0.27	0.27	0.16	0.16	0.32	------
S 124 [8]	0.6 mile west of Gould Island, Sakonnet River (41°36.9′ N., 71°14.0′ W.), Sept. 10–12.	1½	Pole	3½	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
		1½	do	3½	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
		1½	Meter	3	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
		1½	do	11	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------

See footnotes at end of table.

106215 O—38——4

Table 1.—*Current Data, Narragansett Bay—Continued*

Station	Observer, location, and date	Observations: Period	Method	Depth	True directions and velocities: Units	Hours after high water: 0	1	2	3	4	5	6	7	8	9	10	11	12	Nontidal current[1]
	J. C. SAMMONS, 1930—Continued	*Days*		*Feet*															
S 125	0.7 mile north of McCurrys Point (41°35.2′ N., 71°14.0′ W.), Sept. 9–10.	1	Pole	3½	Degrees	170	164	160	158	150				0	352			176	S.
		1	do	3½	Knots	0.10	0.21	0.26	0.21	0.05	0.00	0.00	0.00	0.05	0.05	0.00	0.00	0.10	0.06
		1	Meter	3	do	0.21	0.26	0.36	0.26	0.26	0.10	0.21	0.15	0.15	0.10	0.10	0.15	0.41	
		1	do	11	do	0.15	0.21	0.31	0.21	0.26	0.05	0.10	0.10	0.00	0.10	0.10	0.15	0.31	
S 126	0.2 mile west of Sapowet Point (41°35.2′ N, 71° 13.2′ W.), Sept. 9–12	2½	Pole	3¼	Degrees	342	154	195	166	165	140	351	63	50	357	24	6	25	N.
		2½	do	3¼	Knots	0.15	0.36	0.38	0.40	0.27	0.17	0.17	0.32	0.19	0.13	0.36	0.19	0.07	0.01
		2½	Meter	7	do	0.23	0.29	0.32	0.40	0.29	0.36	0.29	0.32	0.23	0.42	0.37	0.26	0.32	
		2½	do	18	do	0.32	0.27	0.34	0.38	0.27	0.32	0.38	0.29	0.40	0.42	0.40	0.40	0.32	
		2½	do	30	do	0.44	0.34	0.27	0.32	0.32	0.38	0.36	0.34	0.36	0.37	0.42	0.34	0.39	
S 127[4]	0.5 mile S. 33° E. of High Hill Point (41°32.4′ N., 71°12.6′W.), Sept. 5–6.	1	Pole	3½															
		1	do	3½															
		1	Meter	4															
		1	do	16															
S 128	0.4 mile N. 12° W. of Flint Point (41°29.6′ N., 71°14 4′ W.), Sept. 3–4.	1	Pole	3¼	Degrees		69	164	136	186	182	204	129	118	249	102	122		S
		1	do	3¼	Knots	0.00	0.07	0.13	0.33	0.33	0.13	0.33	0.13	0.33	0.07	0.13	0.13	0.00	0.07
		1	Meter	4	do	0.20	0.26	0.33	0.33	0.33	0.33	0.39	0.39	0.52	0.33	0.46	0.39	0.33	
		1	do	10	do	0.26	0.26	0.39	0.33	0.52	0.20	0.33	0.33	0.52	0.33	0.46	0.39	0.33	
		1	do	16	do	0.26	0.26	0.39	0.26	0.26	0.13	0.26	0.33	0.33	0.39	0.46	0.39	0.33	
S 129	0.2 mile, S. 40° W. of Breakwater Light, Sakonnet River (41°27.8′ N., 71°12.0′ W.), Sept. 3–4.	1	Pole	7	Degrees	193	179	186	199	202	192	200	182	198		39	181	221	S
		1	do	7	Knots	0.13	0.13	0.26	0.46	0.52	0.59	0.26	0.17	0.30	0.00	0.07	0.07	0.26	0.18
		1	Meter	7	do	0.59	0.52	0.66	0.72	0.72	0.66	0.59	0.56	0.56	0.66	0.66	0.66	0.66	
		1	do	18	do	0.59	0.52	0.66	0.66	0.59	0.72	0.72	0.56	0.56	0.52	0.66	0.59	0.52	
		1	do	29	do	0.59	0.52	0.59	0.52	0.52	0.52	0.52	0.48	0.48	0.52	0.66	0.52	0.39	
S 130[4]	0.4 mile, N. 35° E. of Sakonnet Light (41°27.5′ N., 71°11.9′ W.), Sept. 3–4.	1	Pole	3½															
		1	do	3½															
		1	Meter	4															
		1	do	16															
S 131	0.7 mile, S. 20° E. of Sakonnet Light (41°26.5′ N., 71°11.8′ W.), Sept. 4–5.	1	Pole	7	Degrees	277	280	274	313	336	324	314		290	278	290	251	278	W
		1	do	7	Knots	0.29	0.23	0.18	0.18	0.18	0.18	0.29	0.00	0.53	0.47	0.35	0.35	0.18	0.23
		1	Meter	7	do	0.53	0.41	0.47	0.47	0.47	0.53	0.53	0.64	0.88	0.70	0.58	0.53	0.53	
		1	do	18	do	0.47	0.47	0.41	0.53	0.41	0.47	0.58	0.64	0.64	0.58	0.64	0.47	0.53	
		1	do	29	do	0.41	0.41	0.41	0.47	0.47	0.47	0.58	0.58	0.64	0.53	0.58	0.41	0.47	
S 132[4]	0.5 mile, S. 66° W. of Warren Point (41°27.5′ N., 71°10.8′ W.), Sept. 4–5.	1	Pole	7															
		1	do	7															
		1	Meter	6															
		1	do	15															
		1	do	24															
S 133[4]	0.8 mile, N. 75° E. of Easton Point (41°29.0′ N., 71°15.5′ W.), Sept. 8–9.	1	Pole	3½															
		1	do	3½															
		1	Meter	4															
		1	do	16															
S 134[4]	*0.6 mile west of Easton Point (41°28.8′ N.,71°17.3′ W.), Sept. 8–9.*	1	Pole	7															
		1	do	7															
		1	Meter	4															
		1	do	14															
S 135[4]	0.2 mile, N. 30° E. of Sheep Point (41°27.8′ N., 71°18.1′ W.), Sept. 8–9.	1	Pole	3¼															
		1	do	3¼															
		1	Meter	4															
		1	do	14															
S 136	0.3 mile, S. 17° E. of Coggeshall Ledge Tower (41°26.8′ N., 71°18.6′ W.), Sept. 8–9.	1	Pole	7	Degrees	244	219				254		281	228	256	252	238	225	SW.
		1	do	7	Knots	0.20	0.10	0.00	0.00	0.00	0.05	0.00	0.20	0.20	0.15	0.20	0.20	0.20	0.13
		1	Meter	7	do	0.35	0.35	0.35	0.35	0.30	0.20	0.25	0.30	0.30	0.25	0.35	0.30	0.20	
		1	do	17	do	0.30	0.35	0.30	0.30	0.35	0.20	0.30	0.23	0.25	0.30	0.30	0.30	0.20	
		1	do	26	do	0.30	0.30	0.35	0.30	0.30	0.20	0.20	0.27	0.30	0.30	0.30	0.25	0.20	
	G. E. BOOTHE, 1931																		
Bo 1	N. Y., N. H. & H. R. R. bridge, Seekonk River (41°49.0′ N., 71°23.3′ W.), Sept. 21–24.	2½	Pole	3½	(1)	N.	S.	S.	S.	S.	S.	N.	N.	N.	N.	N.	N.	N.	N.
		2½	do	3½	Knots	0.27	0.68	1.02	1.26	1.40	0.94	0.13	1.07	0.63	0.52	1.16	1.29	0.96	0.02
		2½	Meter	5	do	0.55	0.60	1.07	1.31	1.42	0.92	0.46	1.02	0.55	0.48	1.13	1.24	0.87	
		2½	do	12	do	0.44	0.44	0.87	1.20	1.33	0.81	0.37	1.05	0.52	0.52	0.96	1.16	0.85	
		2½	do	19	do	0.35	0.41	0.89	1.16	1.22	0.72	0.46	1.05	0.46	0.48	0.89	1.13	0.71	
Bo 2	West Draw, Red Bridge, Seekonk River (41°49.6′ N., 71°22.8′ W.), Sept. 21–24.	2½	Pole	6½	(1)	N.	S.	S.	S.	S.	S.	N.	N.	N.	N.	N.	N.	N.	S.
		2½	do	6½	Knots	0.13	0.63	0.92	1.02	1.31	0.81	0.11	0.76	0.33	0.28	0.68	1.07	0.62	0.06
		2½	Meter	4	do	0.33	0.60	0.98	1.26	1.46	0.98	0.56	0.81	0.46	0.35	0.81	0.96	0.63	
		2½	do	10	do	0.31	0.49	0.96	1.11	1.35	0.78	0.54	0.81	0.41	0.38	0.74	0.96	0.60	
		2½	do	17	do	0.27	0.52	0.85	1.02	1.26	0.74	0.38	0.59	0.33	0.35	0.65	0.85	0.49	
Bo 3	Stone Bridge, Sakonnet River (41°37.5′ N., 71°13.0′ W.), Sept. 21–24.	2¼	Pole	7	(1)	S.	S.	S.	S.	S.	N.	N.	N.	N.	N.	N.	N.	S.	N.
		2½	do	7	Knots	1.47	2.64	2.46	2.29	0.91	0.75	2.91	[8] 1.53	[9] 0.56	[10] 1.28	2.41	2.04	0.93	0.09
		2¼	Meter	6	do	1.85	2.46	2.16	2.04	1.49	1.53	2.66	1.66	1.07	1.39	2.24	2.04	1.00	
		2½	do	15	do	1.83	2.49	2.22	2.11	1.51	1.53	2.66	1.64	1.02	1.35	2.22	2.04	0.95	
		2¼	do	24	do	1.85	2.60	2.31	2.13	1.47	1.55	2.66	1.58	1.04	1.39	2.29	2.00	0.91	
Bo 4	Railroad bridge, Tiverton, Sakonnet River (41°38.3′ N., 71°12.9′ W.), Sept. 21–24.	2¼	Pole	7	(1)	S.	S.	S.	S.	S.	N.	N.	N.	S.	N.	N.	N.	S.	S.
		2½	do	7	Knots	1.62	2.13	1.69	1.31	0.16	1.35	2.15	[11] 0.91	[12] 0.16	[13] 0.67	1.44	0.53	1.28	0.01
		2½	Meter	4	do	2.02	2.42	1.86	1.42	0.73	1.55	2.09	0.87	0.91	1.07	1.42	0.80	1.27	
		2¼	do	11	do	2.09	2.51	1.91	1.44	0.80	1.53	2.06	0.87	0.93	1.07	1.44	0.73	1.27	
		2½	do	17	do	2.11	2.55	1.98	1.44	0.78	1.51	2.29	0.91	0.87	1.07	1.53	1.04	1.42	

[1] Directions given in points of the compass are general directions.
[2] See also table 2.
[3] Each station represents 3 or more stations occupied simultaneously but combined because of their close proximity to one another The results given include observations for the range of depths indicated. The position in each case is the approximate mean position of each group.
[4] Practically no tidal current.
[5] Average value. Actual observations vary from 0.2 knot southward to 2.4 knots northward.
[6] Average value. Actual observations vary from 0.4 knot southward to 0.6 knot northward.
[7] Average value. Actual observations vary from 0.8 knot northward to 1.5 knots northward.
[8] Average value. Actual observations vary from 0.6 knot northward to 2.5 knots northward.
[9] Average value. Actual observations vary from 1.5 knots northward to 1.2 knots southward.
[10] Average value. Actual observations vary from 0.4 knot northward to 1.7 knots northward.
[11] Average value Actual observations vary from 0.0 knot to 2.2 knots northward.
[12] Average value. Actual observations vary from 0.8 knot northward to 1.1 knots southward.
[13] Average value. Actual observations vary from 2.0 knots northward to 0.3 knot southward.

For reference to above table, see p. 21.

TABLE 2.—***Current Data, Narragansett Bay, Slacks and Strengths***

[Referred to times of high water at Newport]

Station no.	Location	Observations				Slack	Flood strength			Slack	Ebb strength			Nontidal current
		Date	Period	Method	Depth		Time	Direction (true)	Velocity		Time	Direction (true)	Velocity	
			Days		*Feet*	*Hours after high water*	*Hours after high water*	*Degrees*	*Knots*	*Hours after high water*	*Hours after high water*	*Degrees*	*Knots*	*Knots*
LS	Brenton Reef Lightship (41°25.9′ N., 71°22.6′ W.).[1]	Oct. 1-Dec. 26, 1913.	87	Pole	7	6. 72	10. 06	356	0. 50	0. 52	3. 57	175	0. 70	0.10 southward.
		June 16-Oct. 31, 1919.	120	do	7	6. 48	10. 08	353	0. 46	0. 60	3. 47	156	0. 53	0.03 eastward.
		July 27, 1930-July 31, 1931	370	do	7	6. 60	10. 60	343	0. 35	0. 40	3. 50	174	0. 60	0.06 southward.
M "A"	0.1 mile east of India Point (41°49.0′ N., 71° 23.3′ W.).[2]	Sept. 8-Oct. 10, 1874.	15			6. 29				0. 41				
P 4	0.3 mile west of Rose Island Light (41°29.8′ N., 71°21.0′ W.).	August 1889						Northerly.	0. 50			Southerly.	0. 85	

[1] See also table 1.
[2] Only slack waters observed.

For reference to above table, see p. 21.

TABLE 3.—*Current Harmonic Constants, Brenton Reef Lightship*

[From 87-day series, June 17—Sept. 11, 1919]

Constituent	North component (magnetic)			East component (magnetic)		
	Velocity H	Epochs		Velocity H	Epochs	
		Local (κ)	Greenwich		Local (κ)	Greenwich
	Knots	*Degrees*	*Degrees*	*Knots*	*Degrees*	*Degrees*
K_1	0.048	38	109	0.045	114	185
M_2	0.277	149	292	0.041	60	202
M_4	0.070	69	354	0.014	288	213
M_6	0.025	164	233	0.018	234	303
N_2	0.096	118	260	0.045	104	247
O_1	0.014	155	226	0.019	94	165
S_2	0.067	158	301	0.025	137	280

Magnetic variation, 14° west.
Epochs apply to flood strength of the several constituents.
The local epochs refer to the local meridian, Greenwich epochs to the Greenwich meridian.
For reference to above table, see p. 21.

TABLE 4.—*Times and Velocities of Flood Strength of M_2, M_4, and M_6 Currents*

[Times are in hours after high water at Newport]

EASTERN PASSAGE, PROVIDENCE AND SEEKONK RIVERS

Station no.	Days of observations	M_2		M_4		M_6	
		Time	Velocity	Time	Velocity	Time	Velocity
		Hours	*Knots*	*Hours*	*Knots*	*Hours*	*Knots*
LV	87	9.83	0.28	5.87	0.07	2.44	0.02
S 69	1	9.91	0.94	6.00	0.16	2.58	0.05
S 73	1	9.44	1.21	5.43	0.26	1.17	0.05
S 80	1½	9.88	0.67	5.85	0.25	3.45	0.06
S 86	1	9.73	0.57	6.23	0.13	3.39	0.06
S 96	1	9.32	0.51	6.36	0.26	2.62	0.13
S 97	1	9.65	0.76	6.48	0.23	1.51	0.04
S 101	1	10.15	0.38	6.53	0.06	2.94	0.05
S 53	1	9.70	0.23	5.69	0.09	2.00	0.06
S 57	1	9.60	0.33	5.34	0.12	2.20	0.05
S 60	1	9.34	0.22	5.59	0.10	2.35	0.05
S 61	2	10.34	0.24	5.61	0.17	2.55	0.06
Bo 1	2½	9.54	1.28	5.92	0.36	2.80	0.38
Bo 2	2½	9.53	1.00	5.91	0.36	2.66	0.35
WESTERN PASSAGE TO WARWICK							
S 20	1	9.17	0.54	5.80	0.16	3.15	0.08
S 21	2	10.28	0.67	6.55	0.02	2.88	0.07
S 24	2	9.09	0.85	4.86	0.19	2.28	0.11
S 25	1	9.55	1.04	4.88	0.22	2.67	0.08
S 30	1	9.49	0.66	5.79	0.28	2.46	0.12
S 37	1	8.94	0.39	5.85	0.14	2.23	0.03
S 43	1	9.86	0.31	5.84	0.18	2.16	0.06
S 49	1	8.97	0.61	6.00	0.31	2.16	0.02
BETWEEN GOULD ISLAND AND WARWICK							
S 92	2	8.88	0.50	5.98	0.14	2.79	0.06
S 94	1	9.13	0.48	6.01	0.06	2.90	0.07
S 46	1	9.80	0.43	6.34	0.12	3.01	0.05
EASTERN PASSAGE TO TAUNTON AND KICKAMUIT RIVERS							
S 98	1	9.35	0.70	5.85	0.29	2.77	0.08
S 106	1	9.82	1.12	6.29	0.29	3.32	0.15
S 109	1	10.25	0.41	6.46	0.17	3.88	0.04
S 110	1	9.50	1.57	6.22	0.65	2.61	0.30
S 113	1	9.42	0.48	6.36	0.11	2.76	0.19
S 115	2	9.67	0.67	6.00	0.29	3.14	0.21
SAKONNET RIVER							
S 120	2	9.65	0.26	5.13	0.13	3.67	0.07
S 118	1	9.26	0.43	5.47	0.05	1.51	0.06
S 126	2½	8.89	0.34	5.61	0.14	2.40	0.05
Bo 3	2½	8.19	2.24	4.99	1.21	2.07	0.78
Bo 4	3½	7.48	1.61	4.86	0.94	1.82	0.67

For reference to above table, see p. 26.

PART II—BUZZARDS BAY

INTRODUCTION

Buzzards Bay which indents the south coast of Massachusetts lies east of Narragansett Bay and north of Vineyard Sound. It is separated from the latter waterway by a chain of islands extending in a southwestward direction from Woods Hole to Sow and Pigs Reef, a distance of about 15 nautical miles. The main entrance, between Cuttyhunk Island and the mainland, has a width of approximately 5 miles. From this entrance the bay extends in a northeastward direction for a distance of about 25 miles, the width increasing to 8 or 9 miles at the central portion and decreasing from there to the upper extremity. Depths in excess of 30 feet prevail at the axis except in the extreme upper portion. The shores are irregular and rocky.

Four navigable passages connect Buzzards Bay directly with Vineyard Sound. Of these, Quicks Hole is the deepest and most used, Woods Hole being second in importance. Robinsons Hole and Canapitsit Channel are narrow and shoal and are little used except by small craft. Cape Cod Canal connects Buzzards Bay with Cape Cod Bay. It has a length of about 8 miles exclusive of the dredged approaches and a least depth of 22 feet. A 26-foot dredged channel leads to New Bedford which is an important manufacturing and shipping center on the northwestern side of the bay.

The area included in this discussion comprises Buzzards Bay proper, the passages between Buzzards Bay and Vineyard Sound, and the Cape Cod Canal.

The ocean tides have access to Buzzards Bay directly through the main entrance and indirectly through the several passages connecting with Vineyard Sound. In Buzzards Bay proper the average rise and fall of the tide is approximately 4 feet, and high water occurs near the same time in all parts of the bay. The accompanying currents inside the bay are generally of small velocity, the flood attaining its strength when the tide is rising and the ebb reaching its strength when the tide is falling.

In Vineyard Sound the tidal rise and fall is practically simultaneous with that in Buzzards Bay. The amplitude of the movement, however, is from 1½ to 2½ feet less in Vineyard Sound than in Buzzards Bay. This condition produces alternating differences in water level between the two bodies of water, the water surface of Buzzards Bay being higher at high water and lower at low water than that of Vineyard Sound. As a result, the currents through the connecting passages are to a great extent hydraulic in character and attain large velocities, the southward maximum occurring near the time of high water and the northward maximum near the time of low water.

In the Cape Cod Canal the flow is due to the varying difference in level between Buzzards and Cape Cod Bays. As the tide in Cape Cod Bay has a mean range of about 9½ feet and occurs approximately 3 hours later than the 4-foot tide of Buzzards Bay, the periodic differences in level are large and the resulting currents strong. The eastward and westward currents in the canal reach their strengths of 3 to 4 knots about 11 hours and 4 hours, respectively, after high water in Buzzards Bay, or approximately 1 hour after low and high waters in Cape Cod Bay. Daily predictions of the times and velocities of the current in the Cape Cod Canal at Bournedale, Mass., are given in the annual Current Tables for the Atlantic Coast of North America.

OBSERVATIONS

The earliest current observations on record for the Buzzards Bay area were taken in connection with a hydrographic survey conducted by G. S. Blake in 1844 and 1845. Seven stations distributed over the bay from the entrance to Butlers Point and one station in Quicks Hole were occupied. The period of observations at each station varied from one-half to 3¼ days. During the period 1849–52 the surveying parties of J. R. Goldsborough and M. Woodhull observed currents at 19 locations in or near the passages connecting Buzzards Bay with Vineyard Sound. One or more days of observations were secured at each location. In 1896, J. C. Hanus obtained short series of current observations at four stations in Buzzards Bay proper.

With the cooperation of the Bureau of Lighthouses, the Coast and Geodetic Survey secured continuous hourly observations of the velocity and direction of the current at Hen and Chickens Lightship for a period of 3 months in 1913 and for a period of 17 months in 1930–31.

In 1915, the year after the opening of the Cape Cod Canal, W. B. Parsons, chief engineer of the Cape Cod Construction Co., made observations of the current velocity at 10 locations in the canal, and H. P. Ritter, of the Coast and Geodetic Survey, measured velocities at a station midway between the two ends. The 10 stations at which observations were secured by Parsons were reoccupied by United States Army Engineers in 1932, a continuous series covering a period of 8 days being obtained at the central station, and series of 1 day or less at each of the others.

The present (1936) project for increasing the width of the canal presumably will modify somewhat the current regime in the canal. After the work has been completed, further current observations will be secured from which precise values for the times and velocities will be derived.

In 1931, the field work of a comprehensive current survey of Buzzards Bay was executed by a party in charge of G. E. Boothe. From 1 to 3½ days of half-hourly observations were secured at each of 90 stations in the bay and connecting waterways, including the Cape Cod Canal and the passages connecting with Vineyard Sound. At each station observations were taken at the surface and at several subsurface depths.

METHODS OF OBSERVING

The apparatus and methods employed in taking current observations in Buzzards Bay were in general identical with those described for Narragansett Bay on pages 17 and 18, part I, of this publication. It appears that practically all the earlier observations were taken with some form of float attached to a graduated line. Different forms of floats have been used and the designations "log", "chip", and "pole", have been applied to them at different times.

The current pole used in taking observations at Hen and Chickens Lightship was 15 feet long with 1 foot of its length above the water surface. It thus measured the average current for the first 14 feet of depth. A 15-foot current pole was also used by Boothe in 1931 for all stations except those where shallow water made a shorter pole necessary.

METHODS OF REDUCING THE OBSERVATIONS

To avoid unnecessary repetition, references will be made in this section to the explanations of reduction methods given in part I of this publication.

The observations taken in Buzzards Bay and vicinity during the period 1844 to 1896, inclusive, the observations of Parsons and Ritter in 1915, and the United States Army Engineers' observations taken in 1932, were all reduced by the usual method applicable to currents of the reversing type. This method as applied to the 1913 and 1919 series of observations at Brenton Reef Lightship is described on page 18, part I. Various time references were used in the original reductions, but for the uniform presentation of the data all times have been referred by means of known relationships to the same tidal reference, namely, high water at Clark Point. High water alone, rather than both high and low water, was selected for this purpose because of a peculiarity of the tidal rise and fall in this locality which renders the time of low water less definite than that of high water.

For most of the 1931 observations of Boothe, the half-hourly observations of velocity and direction were tabulated in 25 groups, one group for each half hour after the time of high water at Clark Point. Each observed value was assigned to the group to which it most nearly corresponded in time. A separate tabulation was made for each depth at each station. For each half-hourly group an average velocity and an average direction were computed for the surface current as observed by pole, and an average velocity was obtained for each meter depth. The velocities thus obtained were reduced to approximate mean values by the application of a factor which is the ratio of average tidal range at Clark Point to the tidal range for the period covered by the current observations. The mean half-hourly velocities were plotted on cross section paper and from the resulting curves the strengths and slacks were tabulated in the usual manner. For a few of Boothe's stations, other references which appeared more suitable than Clark Point high water were used in the original reductions, but for uniformity of presentation the final time relations were referred to Clark Point high water.

In the reduction of the 1913 and 1930–31 series of observations at Hen and Chickens Lightship, the method used was similar to that described on page 19, part I, for the 1930–31 observations at Brenton Reef Lightship. The hourly velocities were resolved into their north and east components, grouped and averaged to obtain the resultant velocity and direction for each hour of the tide. The times, directions, and velocities of the maximum and minimum currents were obtained from a plotting of the hourly values. The velocity and direction of the nontidal current for each month were also calculated from the resolved velocities.

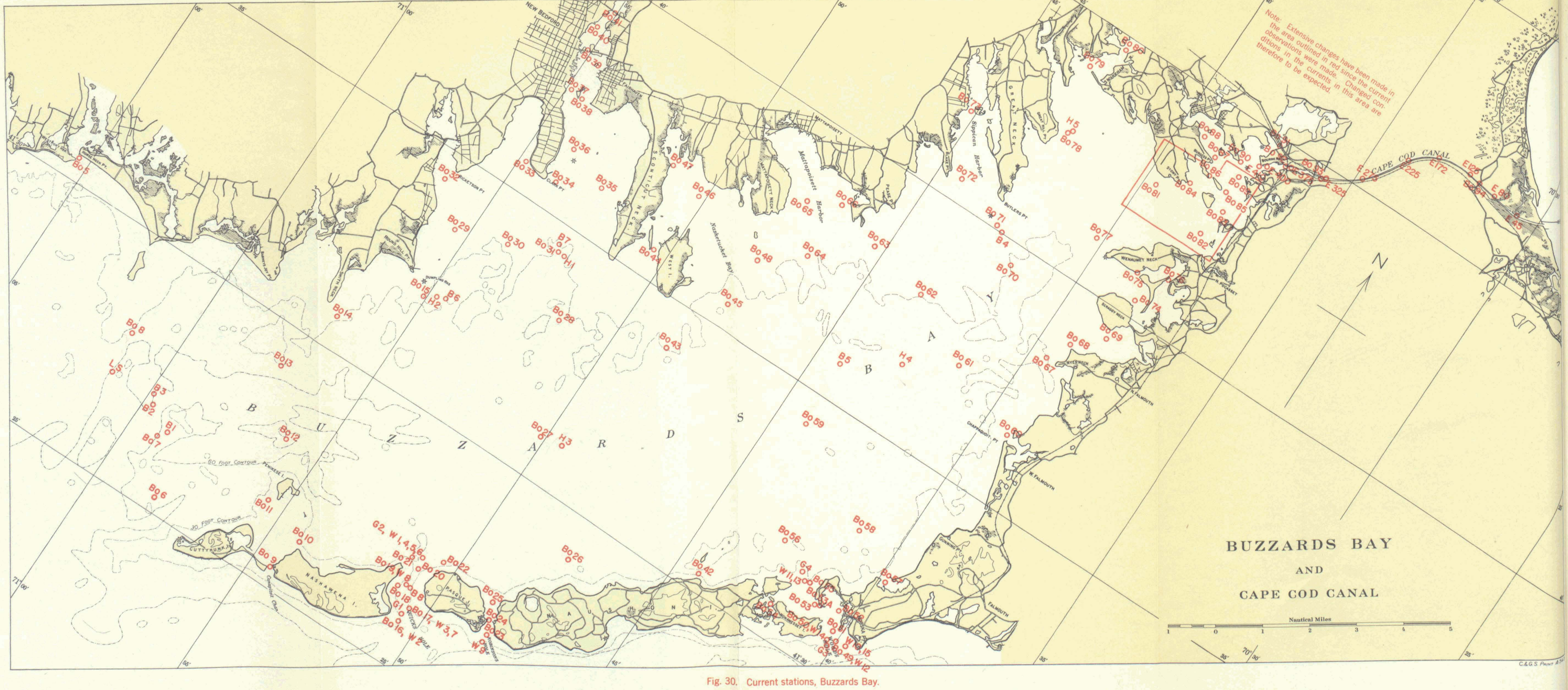

Fig. 30. Current stations, Buzzards Bay.

Two 87-day series of observations at Hen and Chickens Lightship were analyzed harmonically. Following the procedure usually employed for rotary currents, the north and east components of the observed velocities were tabulated and analyzed separately. The 8-day series of current observations obtained by the United States Army Engineers in the Cape Cod Canal was reduced by harmonic analysis and the results corrected by comparison with the results from a similar analysis of a simultaneous series of tides at Commonwealth Piers, Boston. For a detailed explanation of the application of harmonic analysis to the reduction of tides and tidal currents, reference is made to United States Coast and Geodetic Survey Special Publication No. 98, A Manual of the Harmonic Analysis and Prediction of Tides.

PRESENTATION OF THE RESULTS

DESIGNATION AND LOCATION OF STATIONS

Each current station in the Buzzards Bay area has been given a designation which consists generally of two parts; first a letter or letters signifying the party or the chief of the party that occupied the station, and second, a number which is wherever possible the designation originally assigned to the station. The letters forming the first part of the designation and the party signified in each case are as follows:

B=G. S. Blake, 1844–45.
G=J. R. Goldsborough, 1849.
W=M. Woodhull, 1850–52.
H=J. C. Hanus, 1896.
LS=Crew of Hen and Chickens Lightship, 1913, 1930–31.
P=W. B. Parsons, 1915.
R=H. P. Ritter, 1915.
Bo=G. E. Boothe, 1931.
E=United States Army Engineers, 1932.

The locations of the stations are indicated in figure 30 by red circles, together with the corresponding station designations. The stations occupied by Parsons and Ritter in the Cape Cod Canal were reoccupied by United States Army engineers. Each of these is designated in figure 30 by the letter E followed by a number common to the different observing parties which indicates the distance of the station from the eastern end of the canal.

EXPLANATION OF THE TABULAR DATA

Table 5 contains the results derived from the observations at each station. The observations of each party are placed in a separate group and the groups are arranged in chronological order, each under a subhead which indicates the observing party and the year the observations were taken. The station number in the first column of the table corresponds to the designation of the station in figure 30 except that in the Cape Cod Canal where the same stations were occupied by different parties, the letters P and R used in table 5 are omitted in figure 30, the letter E being used for such stations. In the second column, a brief descriptive statement of the station location and its latitude and longitude to the nearest tenth of a minute are given.

Following the location, the dates of the beginning and end of each series of observations, the length of the series in days, the methods used, and the depths at which observations were made, are given. The depth tabulated for the observations taken by pole is in each case one-half the length of the submerged portion of the pole.

In this table, all times are expressed in hours and hundredths. The times of slack water and of flood and ebb strength are referred to high water at Clark Point. The true directions of the current at the times of flood and ebb strength are reckoned from true north (0°), through east (90°), south (180°), and west (270°). In most cases, directions were observed only by pole and consequently no directions are given for the meter depths. The velocities are expressed in knots (nautical miles per hour) and hundredths, and have been corrected to refer them to average tidal conditions. To the velocities obtained from the two series at Hen and Chickens Lightship, no correction was applied as the more important velocity variations average out in the results when the series covers a number of months.

The mean current hour given in the last column of the table is expressed in solar hours and is the mean interval between the Greenwich transit of the moon and the time of the strength of the flood current modified by the times of slack water and strength of ebb. In computing the mean current hour, an average is obtained of the intervals for the following phases: Flood strength, slack before flood increased by one-fourth semilunar day (3.10 hours), slack before ebb decreased by one-fourth semilunar day, and ebb strength increased or decreased by one-half semilunar day (6.21 hours). Before taking the average, the four phases are made comparable by the addition or rejection of such multiples of the semilunar day (12.42 hours) as may be necessary.

The hourly velocities and directions derived from the two relatively long series of current observations at Hen and Chickens Lightship are given in table 6. As in table 5, the directions are true and the velocities are given in knots and hundredths. The first two columns for each series give the average observed velocity and direction for each hour of the tide at Clark Point and the last two columns give the average tidal current for each hour. The tidal current was obtained by eliminating the average nontidal current for each series from each hourly velocity and direction obtained from that series. A graphic representation of the current for each hour of the tide as derived from the 1913 series of observations at Hen and Chickens Lightship is given in figure 31.

In this diagram, each line drawn from the origin *O* represents by its length the mean observed velocity of the current for its particular hour of the tide, and by its direction the average observed direction of the current for that hour. The numbers 0 to 12, inclusive, at the outer ends of the lines indicate hours after high water at Clark Point. The points at the outer extremities of the lines form an approximate ellipse indicated by the dashed line. A point *C* is plotted from the same origin *O*, its distance from *O* denoting the velocity and its direction from *O* the direction of the computed nontidal current. The point *C* is the origin from which the velocity and direction of the tidal current may be measured, a line joining *C* and 2 denoting the velocity and direction of the tidal current 2 hours after high water, and so on. The velocity and direction of the tidal current for each hour may be measured from a diagram of this sort or it may be determined mathematically by subtracting the north and east components of the computed nontidal current from the north and east components of the observed current and obtaining the velocity and direction represented by the resulting components.

The velocity and direction of the nontidal current by months, determined by averaging the resolved hourly velocities, are given in table 7. The nontidal current for each entire series is also given. Because of the irregularity of the direction of the nontidal current, the values for an entire series differ from direct averages of the values for the monthly groups.

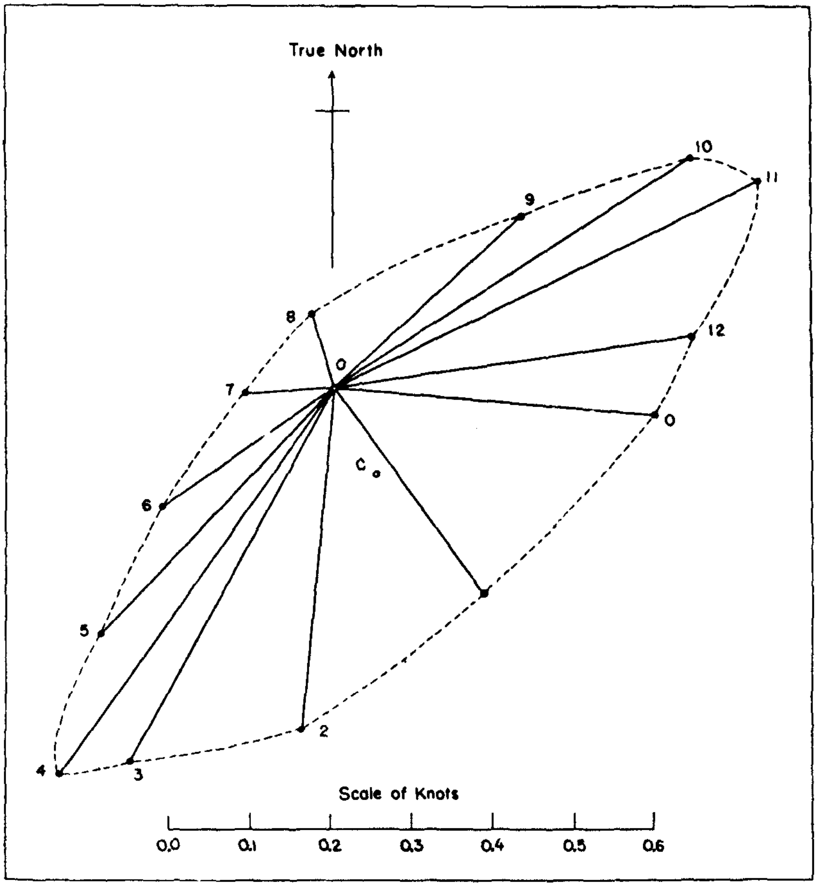

FIGURE 31.—Current ellipse, Hen and Chickens Lightship.

The harmonic constants obtained from separate analyses of the north and east components of two 87-day series of current velocities observed at Hen and Chickens Lightship are given in table 8. For station E 225 the results obtained from the harmonic analysis of an 8-day series of current observations, corrected by comparison with Boston tides as explained on page 51, are given in table 9. As the current at this location is of the reversing type, a single analysis of the velocities was made, the eastward velocities being taken as positive and the westward velocities as negative.

TYPICAL CURRENT CURVES

Typical velocity curves for six stations in Buzzards Bay vicinity are reproduced in figure 32. The curves show the relative times and

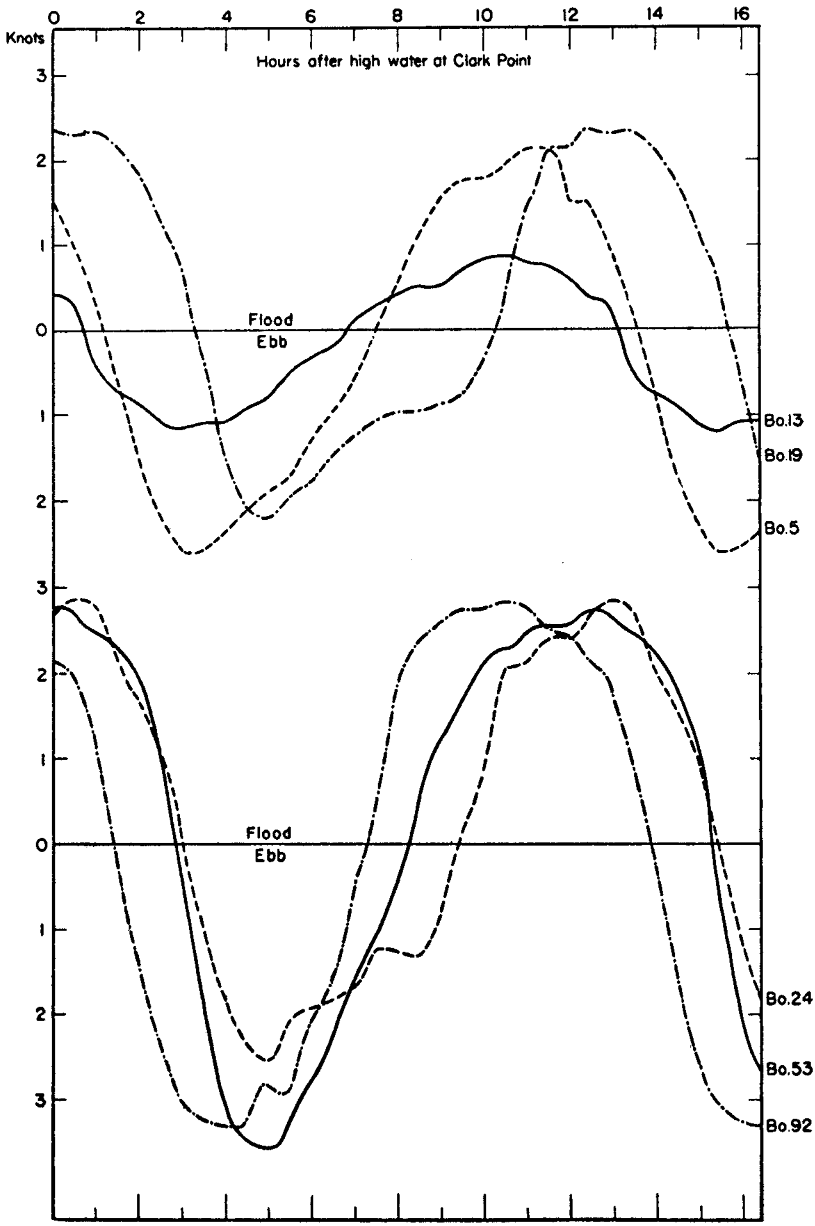

FIGURE 32.—Typical velocity curves, Buzzards Bay vicinity.

velocities of the various phases of the current movement at the different locations. The curve for station Bo 5 in the Westport River entrance shows that the time from flood strength to ebb strength is much shorter than the time from ebb strength to flood strength.

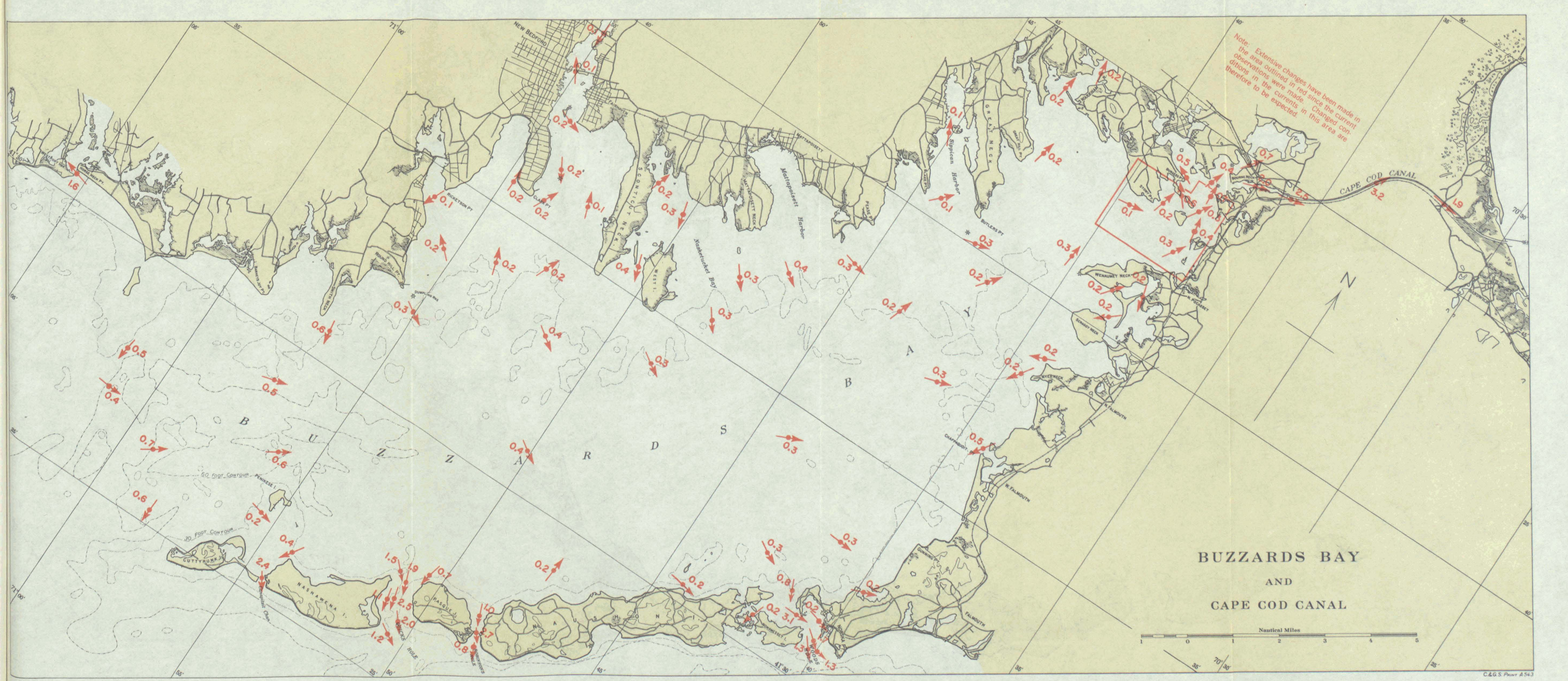

Fig. 33. Currents at time of high water at Clark Point, Mass., or Newport, R.I.

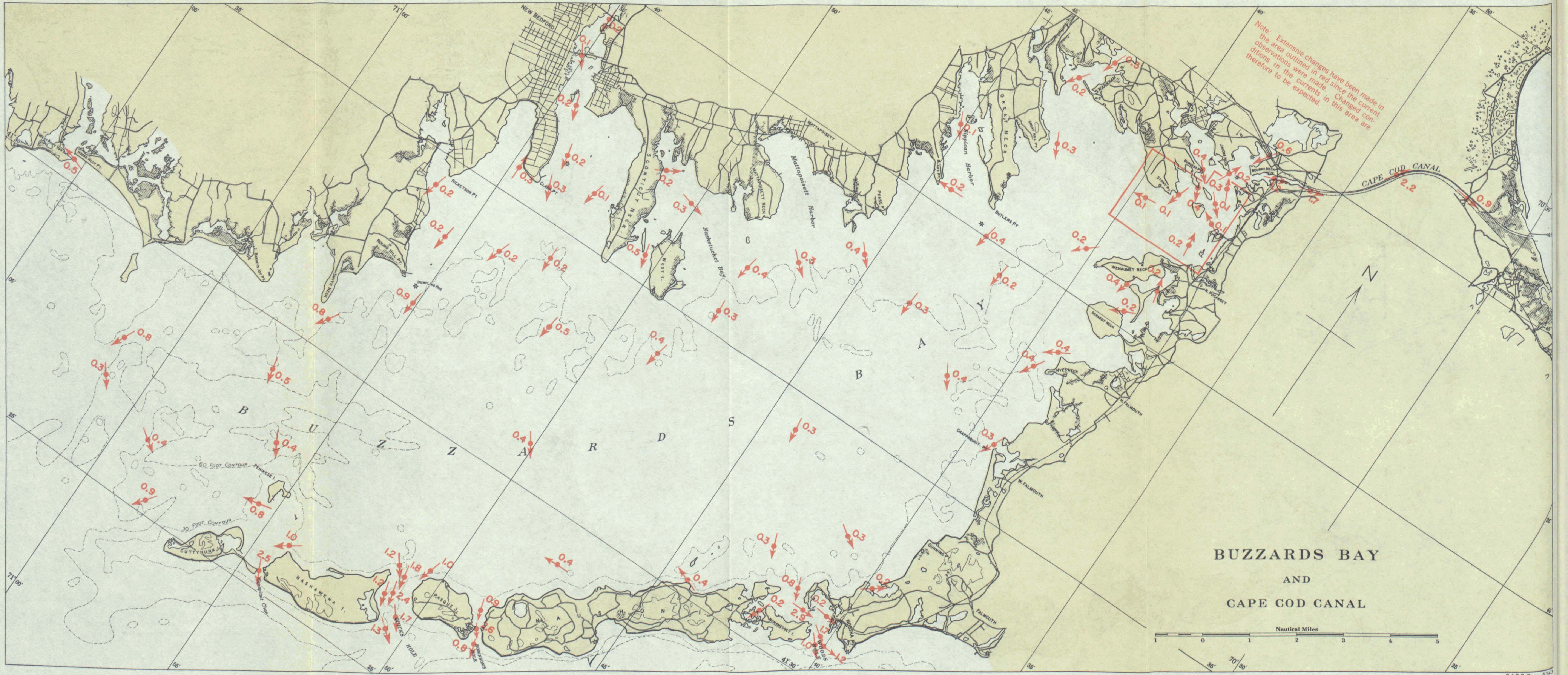

Fig. 34. Currents one hour after high water at Clark Point, Mass., or Newport, R.I.

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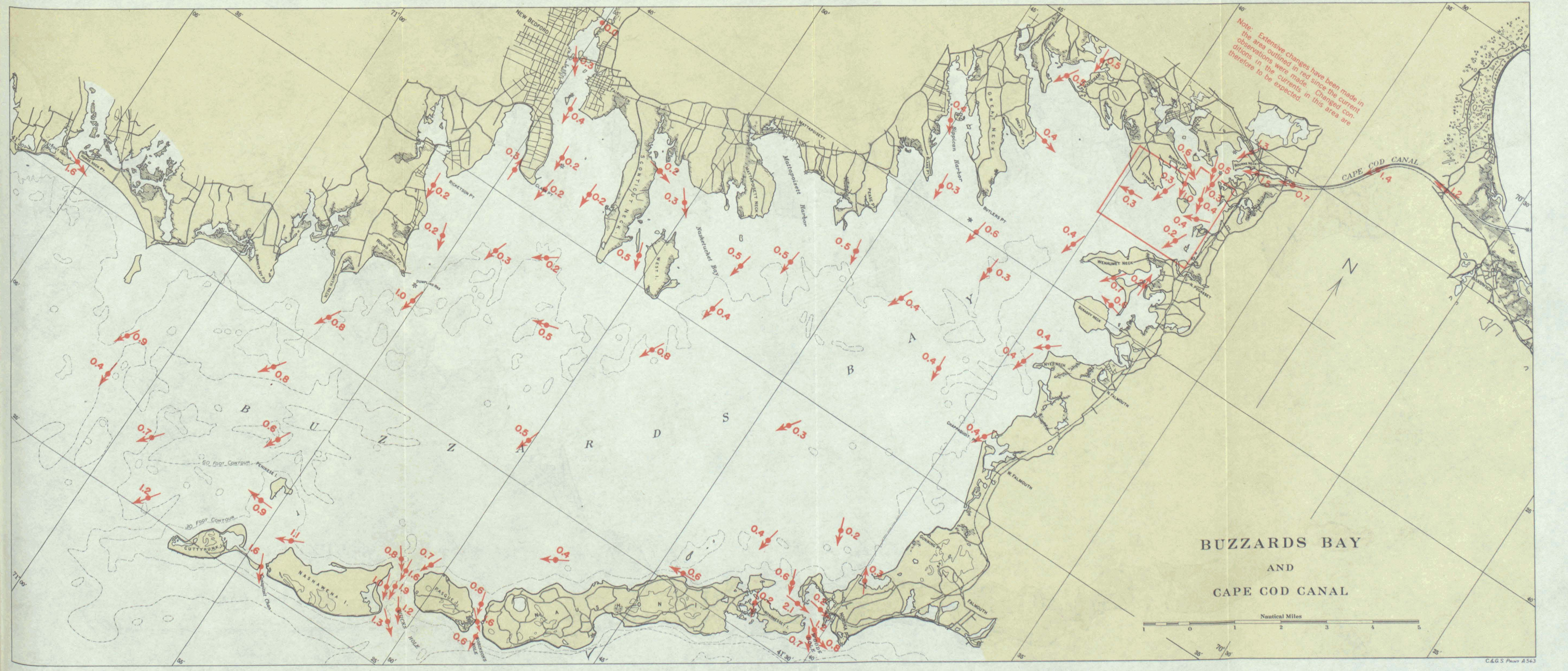

Fig. 35. Currents two hours after high water at Clark Point, Mass., or Newport, R.I.

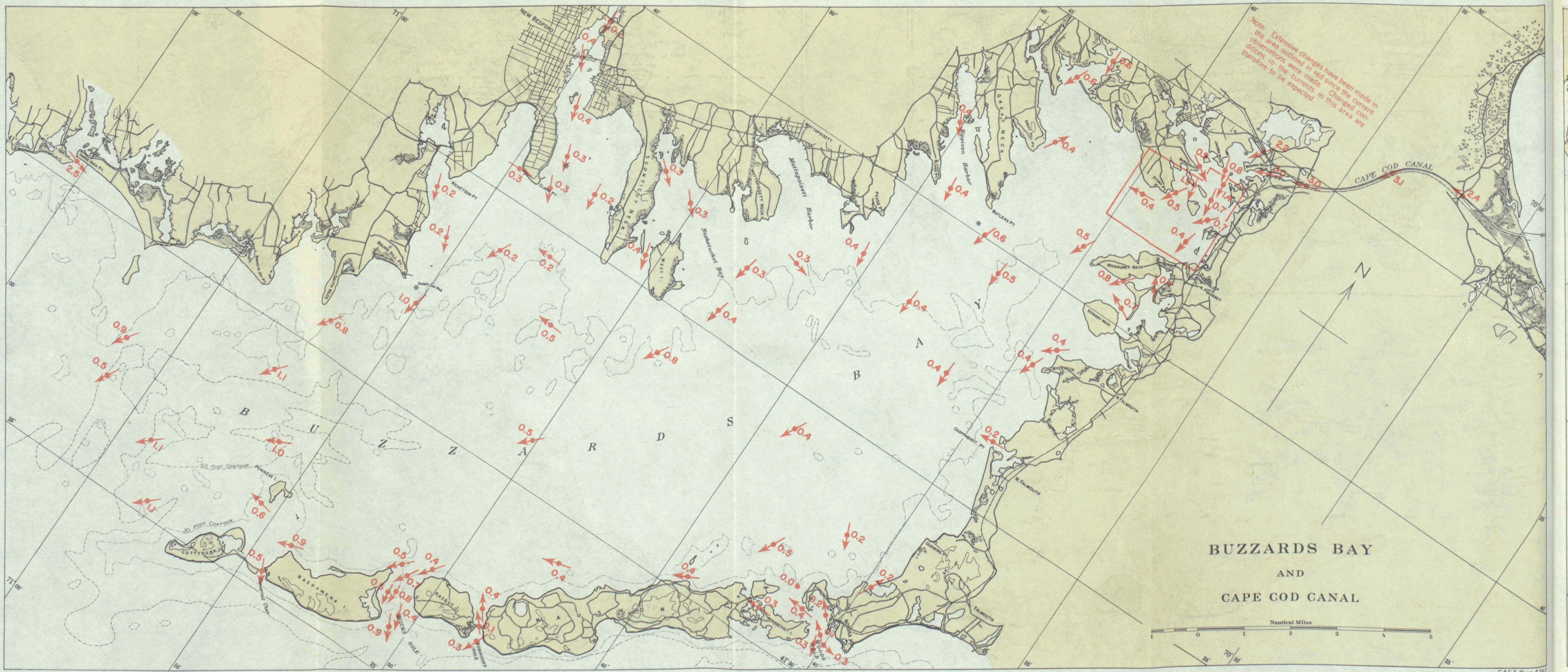

Fig. 36. Currents three hours after high water at Clark Point, Mass., or Newport, R.I.

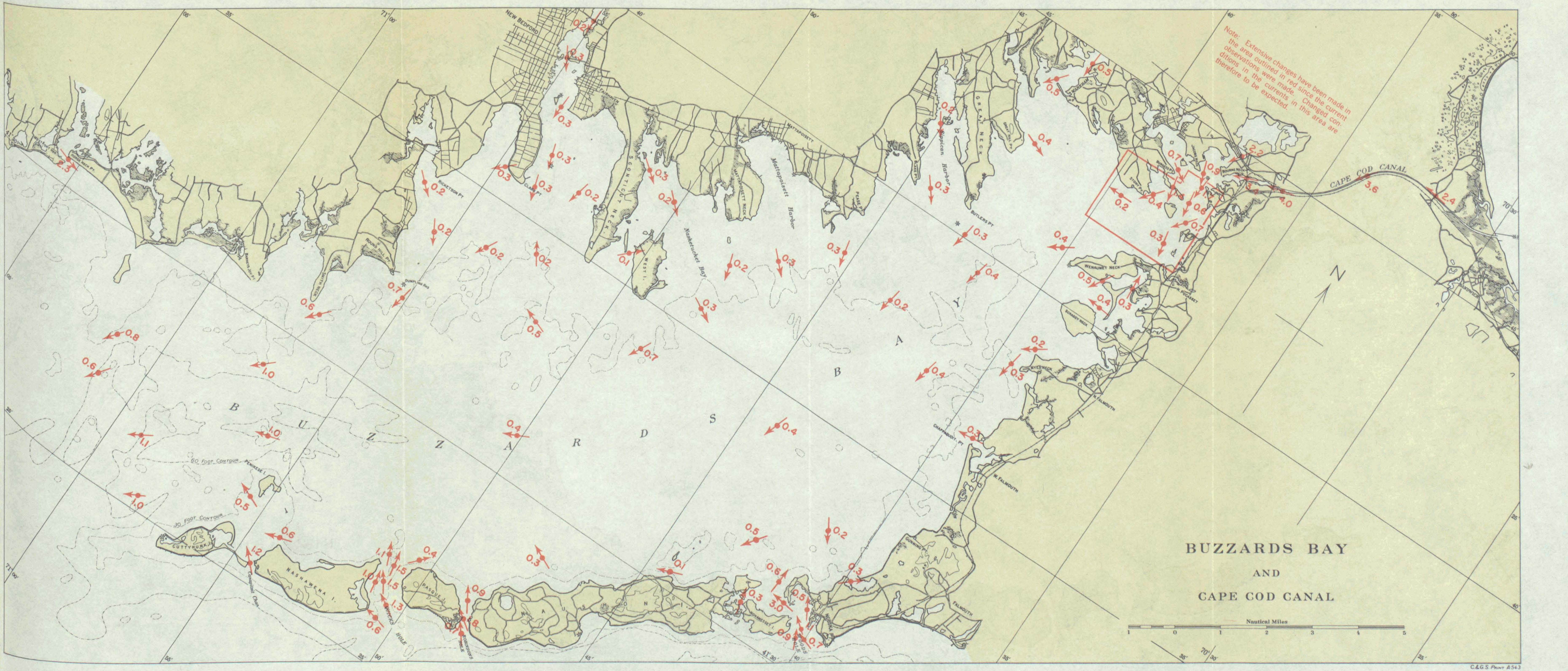

Fig. 37. Currents four hours after high water at Clark Point, Mass., or Newport, R.I.

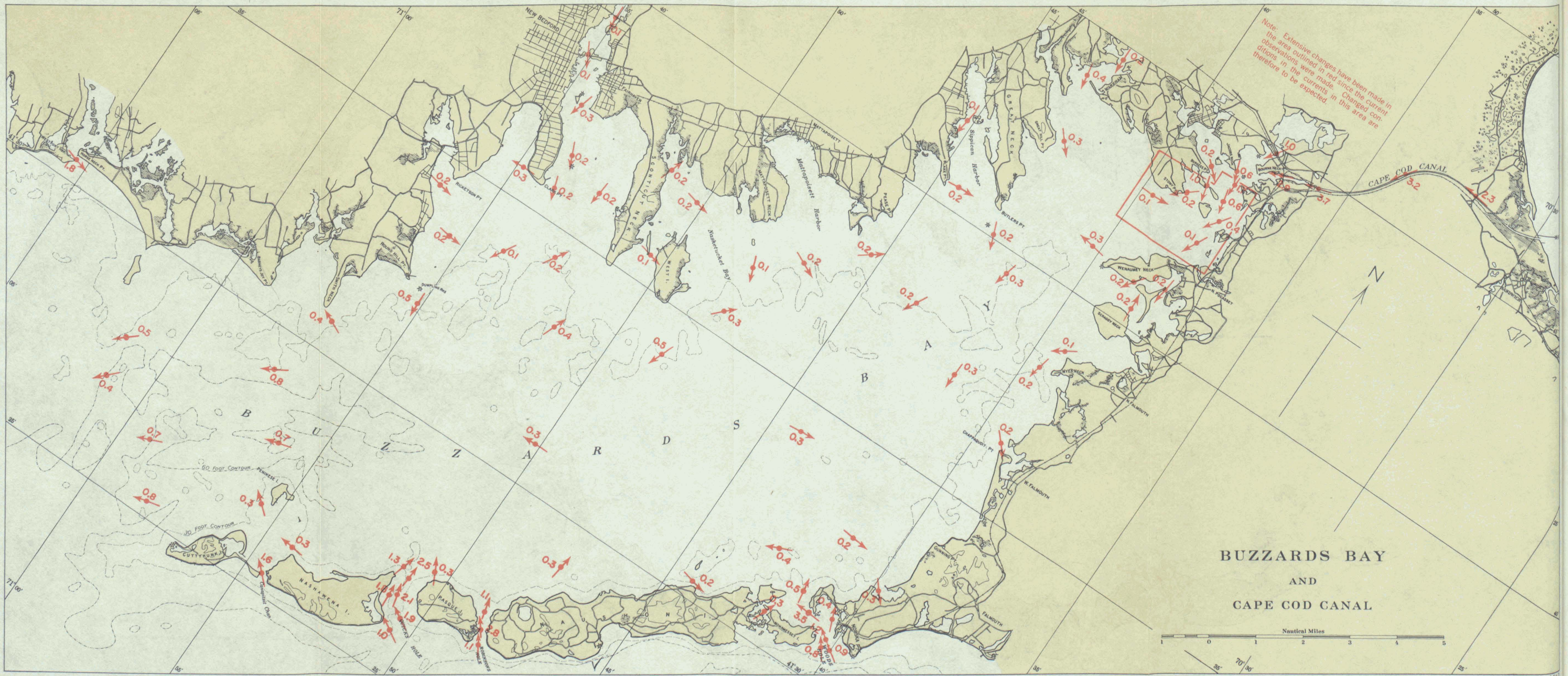

Fig. 38. Currents five hours after high water at Clark Point, Mass., or Newport, R.I.

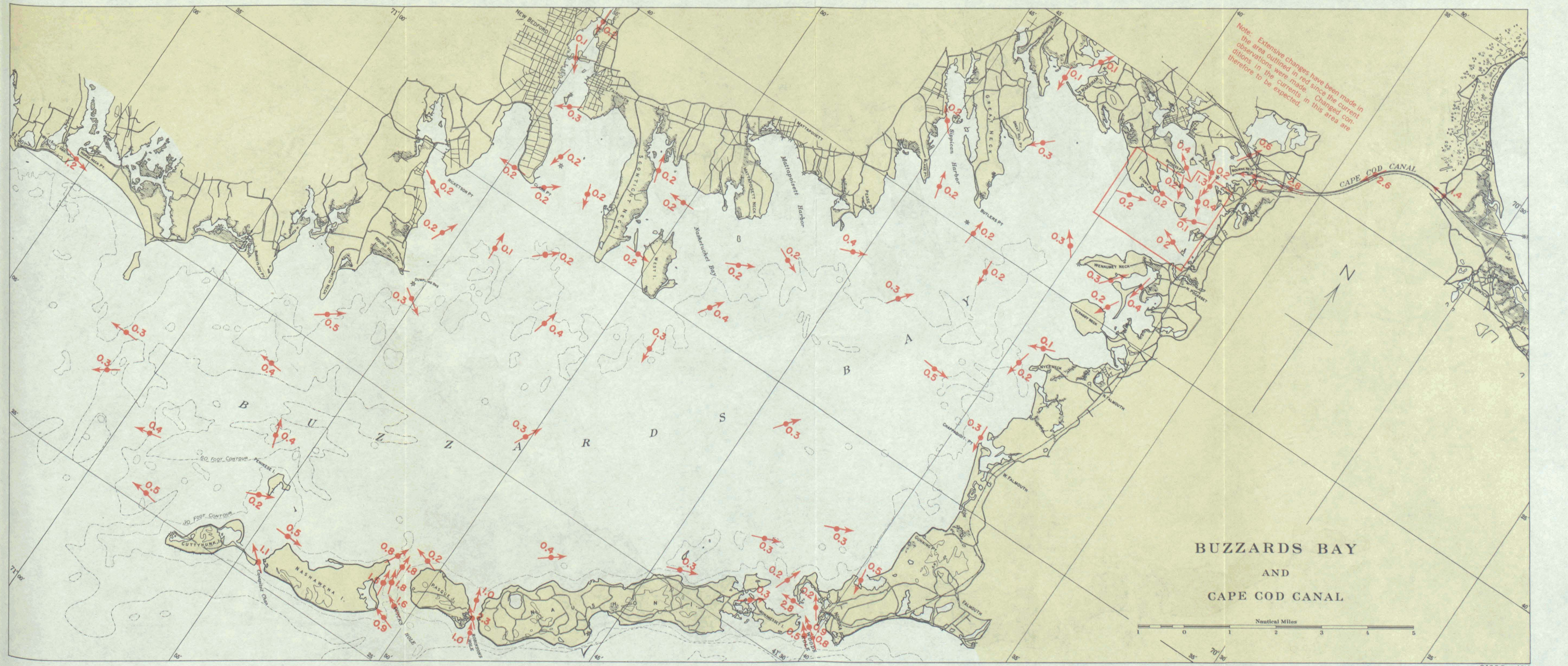

Fig. 39. Currents six hours after high water at Clark Point, Mass., or Newport, R.I.

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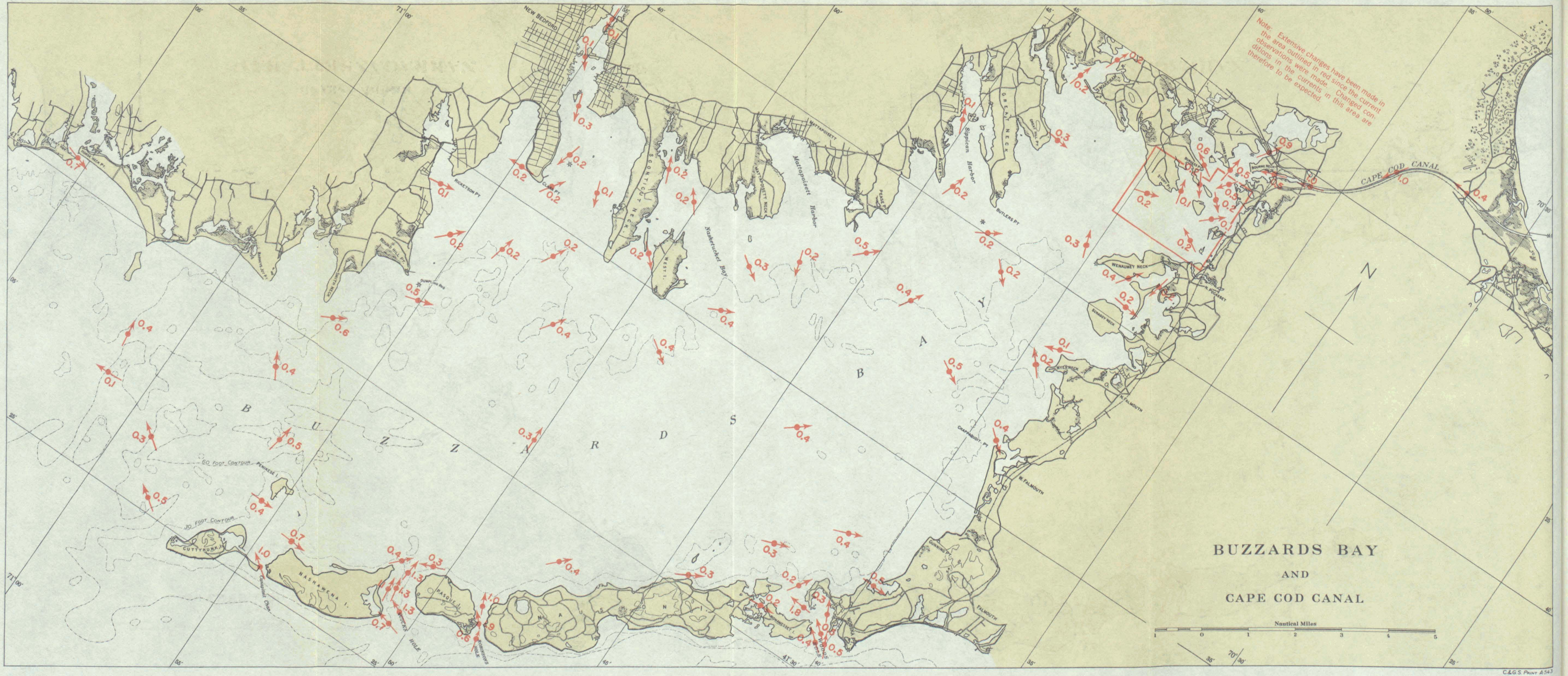

Fig. 40. Currents seven hours after high water at Clark Point Mass., or Newport, R.I.

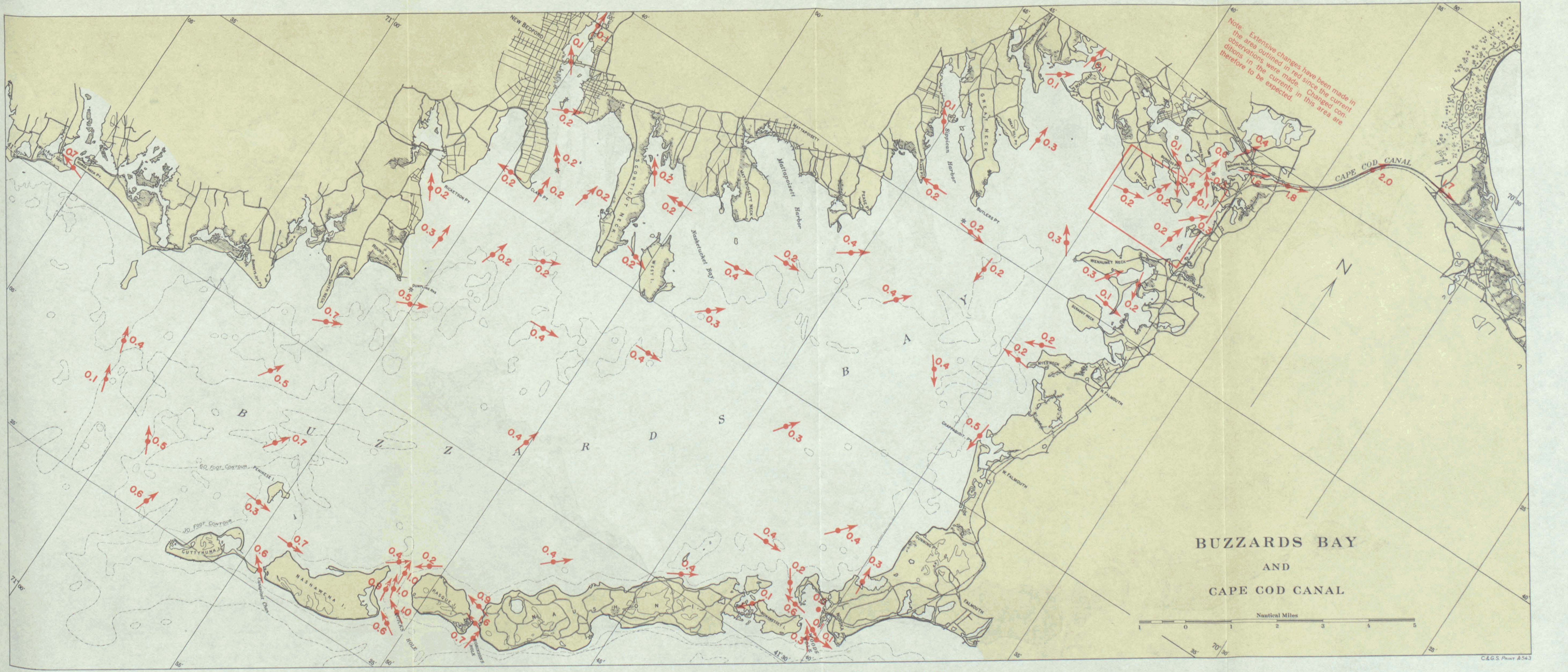

Fig. 41. Currents eight hours after high water at Clark Point, Mass., or Newport, R.I.

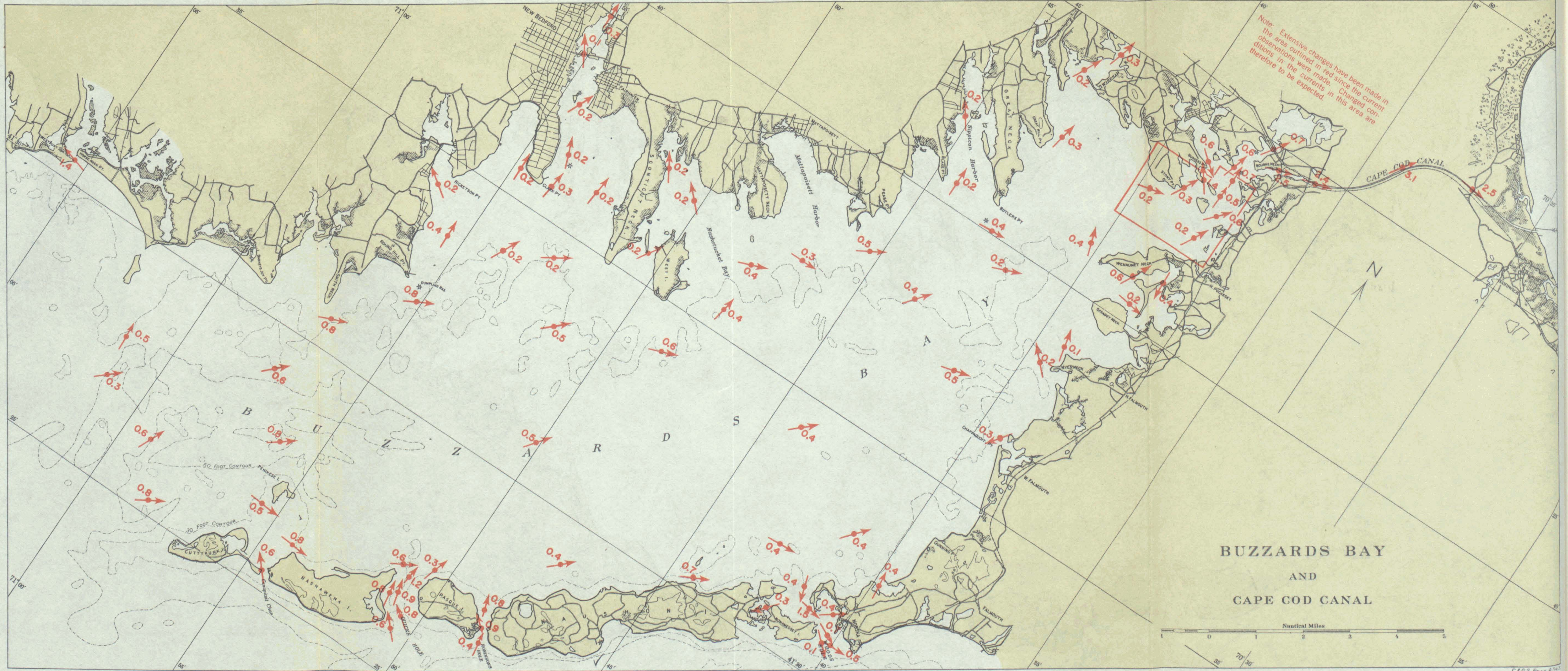

Fig. 42. Currents nine hours after high water at Clark Point, Mass., or Newport, R.I.

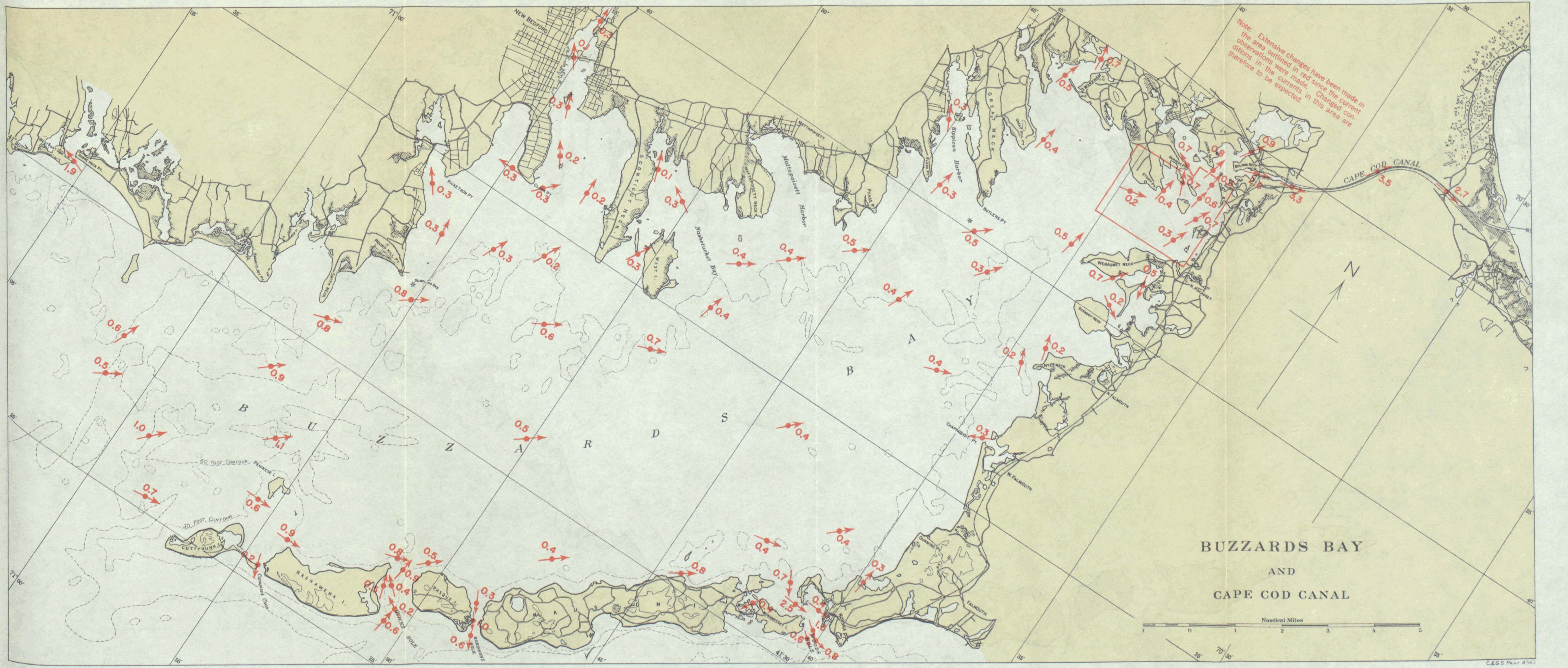

Fig. 43. Currents ten hours after high water at Clark Point, Mass., or Newport, R.I.

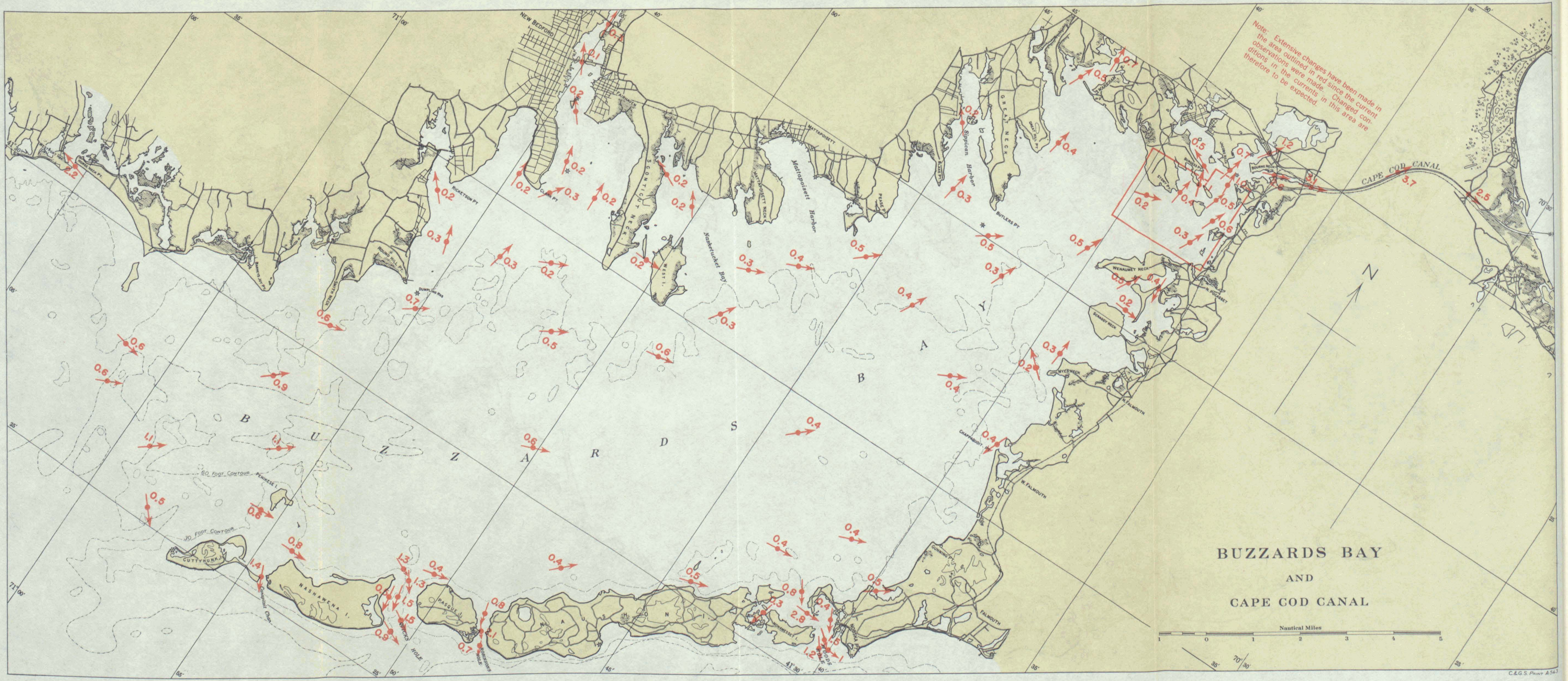

Fig. 44. Currents eleven hours after high water at Clark Point, Mass., or Newport, R.I.

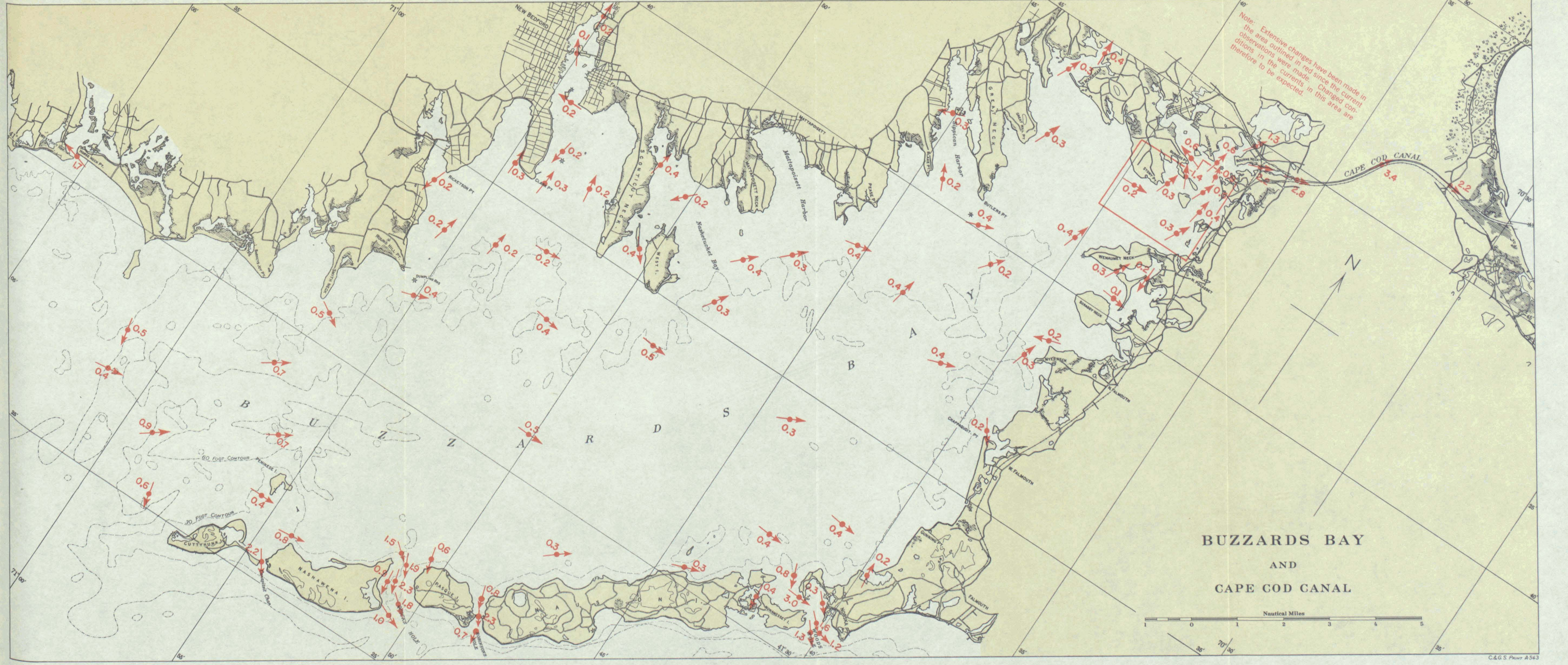

Fig. 45. Currents twelve hours after high water at Clark Point, Mass., or Newport, R.I.

This condition is as indicated by other curves in figure 32, of general occurrence in Buzzards Bay proper and in the passages between Buzzards Bay and Vineyard Sound. The curve for station Bo 92 in the Cape Cod Canal is typical of the current in that waterway in that the periods of time between strengths are approximately equal and the duration of the eastward or flood current is greater than that of the westward current.

CURRENT CHARTS

The observed direction and velocity of the current at a number of locations in Buzzards Bay and vicinity for each hour of the tide at Clark Point are represented in figures 33 to 45. The observations used in preparing the charts were taken within 14 feet of the surface. The locations at which the observations were taken are marked by circles. The observed directions of flow for the designated hours of the tide are represented by arrows drawn through the circles. The mean velocities for the designated hours are shown to the nearest tenth of a knot by numerals near the circles. At times of spring tides and perigean tides, the velocities normally are greater and at times of neap tides and apogean tides less than those given on the charts. The spring and perigean effects are practically equal in this locality, each producing a velocity increase above the mean of about 20 percent. When spring and perigean effects combine, the velocities of the tidal current are greatest. When neap and apogean effects combine, the velocities of the tidal current are least. Winds and other meteorological conditions at times modify both the direction and the velocity of the current.

TABLE 5.—*Current Data, Buzzards Bay*

[Referred to times of high water at Clark Point]

Station no.	Observer, location, and year	Observations: Date	Observations: Period	Observations: Method	Observations: Depth	Slack	Flood strength: Time	Flood strength: Direction (true)	Flood strength: Velocity	Flood duration	Slack	Ebb strength: Time	Ebb strength: Direction (true)	Ebb strength: Velocity	Ebb duration	Mean current hour
			Days		*Feet*	*Hours after high water*	*Hours after high water*	*Degrees*	*Knots*	*Hours*	*Hours after high water*	*Hours after high water*	*Degrees*	*Knots*	*Hours*	*Hours*
	G. S. BLAKE, 1844–45															
B 1	2.3 miles N. 40° W. of Cuttyhunk Light (41°26.6′ N. 70°59.0′ W.).	June 27–28, 1844	¾	Log	0	6.74	10.19	56	0.70	6.45	0.77	3.47	220	0.70	5.97	10.29
B 2	2.9 miles N. 45° W. of Cuttyhunk Light (41°27.0′ N., 70°59.7′ W.).	July 9–10, 1844	1	do	0	6.59	11.34	42	1.02	7.50	1.67	4.02	212	0.57	4.92	10.90
			¾	do	24	6.24	10.79	-------	1.07	7.85	1.67	4.12	-------	0.57	4.57	10.70
B 3	3.2 miles N. 44° W. of Cuttyhunk Light (41°27.2′ N., 70°59.8′ W.).	July 13–14, 1844	1	do	0	6.39	11.47	58	0.92	7.75	1.72	3.77	222	0.72	4.67	10.84
			¾	do	15	6.19	11.64	58	0.87	8.00	1.77	3.87	219	0.72	4.42	10.86
B 4	0.4 mile S. 72° E. of Bird Island Light (41°40.0′ N., 70°42.5′ W.).	Aug. 7–9, 10, 1844	2¼	do	0	(1)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
			2¼	do	16	(1)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
B 5	2.5 miles S. 79° E. of Comorant Rock Beacon (41°35.8′ N., 70°44.3′ W.).	Aug. 12–16, 1844	3¼	do	0	5.59	10.23	30	0.29	7.89	1.06	3.22	212	0.26	4.53	10.02
			3¼	do	14	5.67	10.08	33	0.31	7.78	1.03	3.26	211	0.25	4.64	10.01
B 6	0.6 mile S. 83° E. of Dumpling Rocks Light (41°32.2′ N., 70°54.5′ W.).	Aug. 25, 26, 1845	¾	do	0	9.49	11.19	308	0.32	2.95	0.02	-------	-------	-------	9.47	11.38
B 7	1.4 miles S. 48° E. of Clark Point (41° 34.6′ N., 70°52.7′ W.).	Aug. 27, 1845	½	do	0	6.99	9.89	-------	0.15	5.30	12.29	4.38	223	0.15	7.12	10.28
B 8	0.5 mile N. 64° W. of South Rock, Quicks Hole (41°26.7′ N., 70°50.8′ W.).	Sept. 25–26, 1845	1½	do	9	9.85	0.76	183	1.83	6.68	4.11	6.51	3	1.43	5.74	0.99
	J. R. GOLDSBOROUGH, 1849															
G 1	0.5 mile N. 37° W. of South Rock, Quicks Hole (41°26.1′ N., 70°50.6′ W.).	Nov. 12–13, 1849	1	do	0	9.84	0.62	135	2.39	6.06	3.48	5.48	302	1.39	6.36	0.51
G 2	0.3 mile N. 49° E. of North Rock, Quicks Hole (41°27.3′ N., 70°51.0′ W.).	Nov. 13–14, 1849	1	do	0	9.44	11.84	152	1.40	6.41	3.43	5.53	24	2.15	6.01	0.14
G 3	0.7 mile S. 62° W. of Nobska Point Light (41°30.6′ N., 70°40.2′ W.).	Nov. 5–6, 1849	1	do	0	9.29	12.39	118	0.90	6.01	2.88	6.13	274	1.10	6.41	0.25
G 4	North entrance to Woods Hole (41°31.6′ N., 70°41.9′ W.).	Nov. 10–11, 1849	1	do	0	9.24	12.29	150	0.93	6.16	2.98	5.93	343	0.88	6.26	0.19
	M. WOODHULL, 1850–52															
W 1	0.4 mile N. 43° E. of North Rock, Quicks Hole (41°27.4′ N., 71°51.0′ W.).	Sept. 24–26, 1850	1½	Chip	0	9.12	12.32	166	1.40	6.51	3.21	5.31	357	1.97	5.91	0.08
W 2	0.6 mile S. 31° W. of South Rock, Quicks Hole (41°26.0′ N., 70°50.6′ W.).	Sept. 30–Oct. 1, 1850.	1	do	0	10.29	0.62	82	2.09	5.36	3.23	5.98	296	1.94	7.06	0.71
W 3	0.3 mile S. 30° W. of South Rock, Quicks Hole (41°26.3′ N., 70°50.4′ W.).	July 8–9, 1851	1	do	0	11.09	0.92	108	1.32	5.01	3.68	6.03	281	1.27	7.41	1.11
W 4	0.4 mile N. 47° E. of North Rock, Quicks Hole (41°27.3′ N., 70°51.0′ W.).	July 21–22, 1851	1	do	0	9.54	0.27	140	1.09	6.81	3.93	6.08	14	1.69	5.61	0.64
W 5	0.5 mile N. 44° E. of North Rock, Quicks Hole (41°27.4′ N., 70°50.9′ W.).	July 28–29, 1851	1	do	0	10.44	1.07	190	0.84	5.36	3.38	6.08	16	1.34	7.06	0.92
			1	Pole	7½	10.59	1.12	-------	0.92	5.41	3.58	6.18	-------	1.42	7.01	1.05
W 6	0.3 mile N. 62° E. of North Rock, Quicks Hole (41°27.2′ N., 70 51.0′ W.).	Aug. 9–10, 1851	1	Chip	0	9.54	0.47	158	1.53	6.66	3.78	5.98	12	1.78	5.76	0.62
W 7	0.2 mile S. 41° W. of South Rock, Quicks Hole (41°26.3′ N., 70°50.4′ W.).	Aug. 10–11, 1851	1	do	0	9.69	0.62	126	2.20	6.21	3.48	5.48	298	1.55	6.21	0.50
			1	Pole	7½	9.69	0.62	-------	2.30	6.26	3.53	5.38	-------	1.75	6.16	0.52
W 8	0.5 mile N. 74° W. of South Rock, Quicks Hole (41°26.6′ N., 70°50.8′ W.).	July 16–17, 1852	1	Chip	0	10.40	0.40	S.[7]	2.90	5.96	3.58	4.78	N.[7]	2.48	6.46	0.38
W 9	South entrance to Robinsons Hole (41° 26.6′ N., 70°48.3′ W.).	July 18–19, 1851, Aug. 16–17, 1851.	2	do	0	7.41	11.01	107	0.38	8.11	3.10	5.50	308	0.68	4.31	11.75
W 10	0.3 mile S. 58° W. of Nobska Point Light (41°30.8′ N., 70°39.7′ W.).	Sept. 21–22, 1850	1	do	0	8.34	12.04	93	1.24	6.81	2.73	5.38	276	1.39	5.61	12.12
W 11	0.3 mile N. 53° E. of Uncatena Island, Woods Hole (41°31.5′ N., 70°41.6′ W.).	Sept. 22–23, Oct. 31–Nov. 1, 1850.	2¼	do	0	8.65	11.84	128	0.94	6.29	2.52	5.70	348	1.29	6.13	12.18
W 12	0.6 mile S. 69° W. of Nobska Point Light (41°30.8′ N., 70°40.0′ W.).	Oct. 10–11, 1850	1	do	0	9.29	11.64	123	1.05	5.16	2.03	5.58	316	1.55	7.26	12.13
W 13	0.3 mile N. 37° E. of Uncatena Island, Woods Hole (41°31.5′ N., 70°41.8′ W.).	July 1–2, Aug. 6–7, 1851.	2¼	do	0	8.91	12.07	155	0.64	6.21	2.70	5.78	347	0.88	6.21	12.36
W 14	0.7 mile S. 70° W. of Nobska Point Light (41°30.7′ N., 70°40.2′ W.).	July 5–6, 1851	1	do	0	8.99	12.19	113	0.38	6.04	2.61	5.68	318	0.83	6.38	12.36
W 15	0.3 mile S. 65° W. of Nobska Point Light (41°30.8′ N., 70°39.7′ W.).	July 31–Aug. 1, 1851.	1	do	0	8.09	11.44	118	0.75	6.51	2.18	4.93	272	0.65	5.91	11.66
	J. C. HANUS, 1896															
H 1	1.0 mile S. 61° W. of Sconticut Point (41°34.4′ N., 70°52.4′ W.).	Apr. 9, 1896	½	Pole	6	6.35	10.35	22	0.28	6.55	0.48	3.68	253	0.28	5.87	10.21
H 2	0.4 mile S. 70° E. of Dumpling Rocks Light (41°32.2′ N., 70°54.8′ W.).	do	½	do	6	6.15	9.65	346	0.55	6.55	0.28	3.78	205	0.55	5.87	9.96
H 3	4.5 miles S. 74° E. of Dumpling Rocks Light (41°31.0′ N., 70°49.5′ W.).	Apr. 21–23, 1896	1	do	6	7.60	10.50	54	0.44	6.95	2.13	4.68	223	0.49	5.47	11.22
H 4	3.2 miles S. 57° W. of Nyes Neck (41°36.5′ N., 70°42.8′ W.).	Apr. 23–24, 1896	¼	do	6	-------	8.85	38	0.39	-------	-------	3.28	158	0.39	-------	9.51
H 5	2.7 miles N. 48° W. of Wings Neck Light (41°42.6′ N., 70°42.4′ W.).	Apr. 25, 1896	½	do	6	6.95	10.05	356	0.31	5.45	12.40	3.88	180	0.31	6.97	10.21
	HEN AND CHICKENS LIGHTSHIP, 1913, 1930–31 [2]															
LS	3.8 miles N. 55° W. of Cuttyhunk Light (41°27.1′ N., 71°01.1′ W.).	September–December 1913.	90	do	7	[3] 7.56	10.71	62	0.60	5.75	[3] 0.89	3.76	214	0.59	6.67	10.73
		August 1930–December 1931.	510	do	7	[3] 7.49	11.19	66	0.44	6.02	[3] 1.09	3.79	215	0.44	6.40	10.89

See footnotes at end of table.

TABLE 5.—*Current Data, Buzzards Bay—Continued*

Station no.	Observer, location, and year	Observations: Date	Observations: Period	Observations: Method	Observations: Depth	Slack	Flood strength: Time	Flood strength: Direction (true)	Flood strength: Velocity	Flood duration	Slack	Ebb strength: Time	Ebb strength: Direction (true)	Ebb strength: Velocity	Ebb duration	Mean current hour
	WM. B. PARSONS, CAPE COD CANAL, 1915 [4]		*Days*		*Feet*	*Hours after high water*	*Hours after high water*	*Degrees*	*Knots*	*Hours*	*Hours after high water*	*Hours after high water*	*Degrees*	*Knots*	*Hours*	*Hours*
P 45	41°46.4′ N.; 70°30.6′ W	July 26, Aug. 26	1	Meter	(6)	7.54	10.34	E.[7]	2.16	6.61	1.73	3.53	W.[7]	1.61	5.81	10.78
P 80	41°46.4′ N.; 70°31.5′ W	do	1	do	(6)	7.59	10.27	E.	3.30	6.51	1.68	3.88	W.	2.48	5.91	10.85
P 125	41°46.6′ N.; 70°32.4′ W	do	1	do	(6)	7.54	10.82	E.	3.17	6.61	1.73	4.13	W.	2.34	5.81	11.05
P 172	41°46.5′ N.; 70°33.3′ W	do	1	do	(6)	7.59	10.86	E.	3.03	6.61	1.78	4.18	W.	2.78	5.81	11.10
P 225 [5]	41°46.1′ N.; 70°34.0′ W	do	1	do	(6)	7.69	10.82	E.	3.42	6.46	1.73	4.03	W.	3.30	5.96	11.06
P 275	41°45.2′ N.; 70°34.8′ W	do	1	do	(6)	7.69	10.89	E.	3.23	6.51	1.78	4.08	W.	3.21	5.91	11.11
P 325	41°44.8′ N.; 70°35.7′ W	do	1	do	(6)	7.69	10.72	E.	3.20	6.51	1.78	4.18	W.	3.40	5.91	11.09
P 375	41°44.6′ N.; 70°36.7′ W	do	1	do	(6)	7.69	10.79	E.	2.51	6.51	1.78	4.18	W.	2.94	5.91	11.11
P 400	41°44.3′ N.; 70°37.3′ W	July 26	½	do	(6)	7.79	10.39	E.	1.73	6.51	1.88	4.18	W.	2.83	5.91	11.06
P 410	41°44.3′ N.; 70°37.5′ W	Aug. 26	½	do	(6)	7.69	10.39	E.	1.82	6.51	1.78	3.98	W.	2.92	5.91	10.96
	H. P. RITTER, CAPE COD CANAL, 1915															
R 225 [5]	41°46.1′ N.; 70°34.0′ W	Dec. 3–4, 7–8	1	Float	0	7.69	10.69	E.	2.89	6.41	1.68	4.15	W.	3.76	6.01	11.05
	G. E. BOOTHE, 1931															
Bo 5	Midstream, north of entrance light, Westport River (41°30.5′ N., 71°05.3′ W.).	June 30, July 2	2	Pole	3½	7.50	11.00	290	2.10	6.22	1.30	3.30	108	2.60	6.20	10.75
			2	Meter	5	7.70	10.50	------	2.20	5.92	1.20	3.20	------	2.60	6.50	10.63
			2	do	12	7.80	11.00	------	2.30	5.82	1.20	3.20	------	2.40	6.60	10.78
			2	do	19	7.90	11.00	------	2.00	5.72	1.20	3.40	------	2.40	6.70	10.85
Bo 6	1.0 mile N., 66° W., of Cuttyhunk Light (41°25.3′ N., 70°58.2′ W.).	Aug. 10–12	2	Pole	6½	7.00	9.40	62	0.70	4.40	11.40	2.60	237	1.30	8.02	9.47
			2	Meter	10	7.40	9.40	------	0.80	3.90	11.30	2.50	------	1.20	8.52	9.52
			2	do	25	7.20	9.50	------	0.90	4.10	11.30	3.00	------	1.00	8.32	9.62
			2	do	40	7.20	9.40	------	0.80	4.00	11.20	3.00	------	0.70	8.42	9.57
Bo 7	2.2 miles N., 47° W., of Cuttyhunk Light (41°26.4′ N., 70°59.1′ W.).	June 30, July 2	2	Pole	6½	7.20	10.80	49	1.10	6.42	1.20	3.30	242	1.20	6.00	10.60
			2	Meter	11	7.30	10.80	------	1.20	6.32	1.20	3.50	------	1.20	6.10	10.68
			2	do	28	7.30	10.80	------	1.10	6.32	1.20	3.50	------	0.90	6.10	10.68
			2	do	46	7.20	11.00	------	0.80	6.42	1.20	3.00	------	0.70	6.00	10.58
Bo 8	4.5 miles N., 46° W., of Cuttyhunk Light, (41°28.0′ N., 71°01.3′W.).	do	2	Pole	6½	5.90	10.40	358	0.70	5.90	11.80	2.50	218	0.80	6.52	9.52
			2	Meter	11	5.80	10.00	------	0.70	5.90	11.70	2.80	------	1.10	6.52	9.45
			2	do	26	5.80	10.20	------	0.80	6.00	11.80	2.40	------	1.00	6.42	9.42
			2	do	42	5.80	10.50	------	0.80	6.00	11.80	2.50	------	0.80	6.42	9.52
Bo 9	Center of Canapitsit Channel (41°25.4′ N., 70°54.5′ W.).	July 2–3	1	Pole	3½	10.00	0.50	156	2.40	5.42	3.00	4.70	312	1.60	7.00	0.21
			1	Meter	3	9.90	1.00	------	2.90	5.32	2.80	4.80	------	1.70	7.10	0.29
			1	do	10	9.80	0.60	------	2.20	5.42	2.80	4.80	------	1.40	7.00	0.16
Bo 10	*0.5 mile S. 21° E. of Gull Island (41°26.2′ N., 70°54.2′ W.).*	*do*	*1*	*Pole*	*6½*	*5.20*	*10.60*	*91*	*1.00*	*6.90*	*12.10*	*1.70*	*247*	*1.20*	*5.52*	*9.27*
			1	Meter	5	5.30	9.30	------	0.80	6.70	12.00	1.80	------	1.20	5.72	8.97
			1	do	14	5.30	10.00	------	1.00	6.80	12.10	1.80	------	1.00	5.62	9.17
			1	do	22	5.20	9.00	------	0.90	7.00	12.20	1.80	------	1.00	5.42	8.92
Bo 11	0.2 mile S. 48° W. of south end of Penikese Island (41°26.6′ N., 70°55.5′ W.).	July 2–3–7–8–9	3	Pole	6½	5.80	10.50	93	0.70	6.72	0.10	1.80	287	0.80	5.70	9.53
			3	Meter	6	5.80	10.50	------	0.70	6.82	0.20	1.80	------	1.00	5.60	9.55
			3	do	15, 16	5.80	11.00	------	0.60	6.82	0.20	1.80	------	1.00	5.60	9.68
			3	do	24, 25	5.80	10.00	------	0.60	6.72	0.10	1.60	------	0.80	5.70	9.35
Bo 12	0.8 mile N. 41° W. of Penikese Island (41°27.9′ N., 70°56.2′ W.).	July 13–15	2	Pole	6½	6.00	10.40	50	1.20	7.12	0.70	3.50	254	1.00	5.30	10.13
			2	Meter	11	5.80	10.60	------	1.10	7.42	0.80	3.50	------	1.20	5.00	10.15
			2	do	28	5.80	10.30	------	1.10	7.32	0.70	3.30	------	1.00	5.10	10.00
			2	do	44	5.80	10.30	------	1.00	7.32	0.70	3.20	------	0.90	5.10	9.98
Bo 13	1.7 miles S. 03° W. of Mishaum Point (41°29.1′ N., 70°57.3′ W.).	July 9–10–13–14–15	3	Pole	6½	6.90	10.40	49	0.90	6.22	0.70	3.20	231	1.20	6.20	10.28
			3	Meter	6, 9	6.80	10.40	------	0.90	6.32	0.70	3.00	------	1.10	6.10	10.20
			3	do	16, 22	6.80	10.50	------	0.80	6.32	0.70	2.90	------	1.10	6.10	10.20
			3	do	25, 35	6.80	10.60	------	0.70	6.22	0.60	3.00	------	0.80	6.20	10.23
Bo 14	0.4 mile S. 57° E. of Mishaum Point (41° 30.7′ N., 70°56.8′ W.).	July 13–15	2	Pole	7	5.20	9.00	72	0.80	7.10	12.30	2.40	211	0.80	5.32	9.10
			2	Meter	5	5.30	9.50	------	0.90	6.90	12.20	2.40	------	1.00	5.52	9.22
			2	do	14	5.30	9.50	------	0.70	7.00	12.30	2.40	------	0.90	5.42	9.25
			2	do	23	5.30	9.80	------	0.70	6.90	12.20	2.00	------	0.80	5.52	9.20
Bo 15	0.3 mile S. 28° E. of Dumpling Rocks Light (41°32.0′ N., 70°55.1′ W.).	Aug. 14–15, Sept. 8–9.	2	Pole	6½	5.80	10.00	66	0.90	6.82	0.20	2.00	190	1.10	5.60	9.48
			2	Meter	5, 6	5.80	9.80	------	0.80	6.72	0.10	2.50	------	1.10	5.70	9.53
			2	do	13, 15	5.80	9.80	------	0.80	6.72	0.10	2.40	------	1.00	5.70	9.50
			2	do	21, 24	5.80	9.80	------	0.60	6.72	0.10	2.00	------	0.80	5.70	9.40
Bo 16	0.6 mile S. 24° W. of South Rock, Quicks hole (41°25.9′ N., 70°50.6′ W.).	July 15–17	2	Pole	6½	10.20	1.20	127	1.30	5.82	3.60	5.40	299	1.10	6.60	0.76
			2	Meter	6	10.20	1.20	------	1.40	6.02	3.80	5.50	------	1.00	6.40	0.84
			2	do	15	10.10	1.00	------	1.30	6.12	3.80	5.00	------	0.90	6.30	0.64
			2	do	24	10.30	1.00	------	1.10	5.82	3.70	5.50	------	0.70	6.60	0.79
Bo 17	0.3 mile S. 42° W. of South Rock, Quicks hole (41°26.3′ N., 70°50.5′ W.).	do	2	Pole	6½	10.10	0.00	140	2.00	5.52	3.20	5.20	300	2.10	6.90	0.29
			2	Meter	6	10.30	0.00	------	1.90	5.22	3.10	5.20	------	1.90	7.20	0.31
			2	do	16	10.20	0.00	------	1.90	5.32	3.10	5.00	------	1.80	7.10	0.24
			2	do	25	10.20	0.00	------	1.70	5.32	3.10	5.00	------	1.60	7.10	0.24
Bo 18	0.5 mile S. 22° E. of North Rock, Quicks hole (41°26.6′ N., 70°51.1′ W.).	July 17–18–23–24–25	2½	Pole	6½	10.60	1.00	171	1.20	5.12	3.30	5.10	351	1.80	7.30	0.66
			2½	Meter	6	10.80	1.00	------	1.30	4.92	3.30	5.00	------	1.80	7.50	0.69
			2½	do	15	10.80	1.00	------	1.20	4.82	3.20	5.00	------	1.70	7.60	0.66
			2½	do	24	10.80	0.70	------	1.00	4.82	3.20	5.20	------	1.50	7.60	0.64
Bo 19	0.6 mile S. 44° E. of North Rock, Quicks hole (41°26.6′ N., 70°50.9′ W.).	July 15–18	3	Pole	7	10.30	0.20	167	2.40	5.52	3.40	5.00	339	2.20	6.90	0.39
			3	Meter	8	10.20	0.40	------	2.60	5.42	3.20	5.00	------	2.10	7.00	0.36
			3	do	21	10.30	0.40	------	2.40	5.32	3.20	5.00	------	1.80	7.10	0.39
			3	do	34	10.20	0.20	------	2.10	5.42	3.20	5.00	------	1.80	7.00	0.31
Bo 20	0.4 mile N. 84° E. of North Rock, Quicks hole (41°27.1′ N., 70°51.0′ W.).	July 17–18	1	Pole	6½	10.60	0.40	165	2.10	5.42	3.60	4.80	2	2.60	7.00	0.51
			1	Meter	7	10.60	0.40	------	1.80	5.42	3.60	4.60	------	2.60	7.00	0.46
			1	do	18	10.60	0.20	------	1.80	5.42	3.60	4.60	------	2.30	7.00	0.41
			1	do	29	10.60	0.20	------	1.60	5.42	3.60	4.80	------	1.80	7.00	0.46
Bo 21	0.2 mile N. 34° E. of North Rock, Quicks Hole (41°27.2′ N., 70°51.2′ W.).	July 22–25	2⅓	Pole	7	7.40	12.00	103	1.50	7.92	2.90	4.70	17	1.30	4.50	11.73
			2⅓	Meter	8	7.30	12.00	------	1.50	8.02	2.90	4.70	------	1.40	4.40	11.70
			2⅓	do	20	7.20	11.80	------	1.50	8.02	2.80	4.60	------	1.40	4.40	11.58
			2⅓	do	31	7.40	12.00	------	1.30	7.82	2.80	5.00	------	1.30	4.60	11.78

See footnotes at end of table.

105215 O—38——5

TABLE 5.—*Current Data, Buzzards Bay*—*Continued*

Station no.	Observer, location, and year	Observations: Date	Observations: Period	Observations: Method	Observations: Depth	Slack	Flood strength: Time	Flood strength: Direction (true)	Flood strength: Velocity	Flood duration	Slack	Ebb strength: Time	Ebb strength: Direction (true)	Ebb strength: Velocity	Ebb duration	Mean current hour
	G. E. BOOTHE, 1931—Continued		*Days*		*Feet*	*Hours after high water*	*Hours after high water*	*Degrees*	*Knots*	*Hours*	*Hours after high water*	*Hours after high water*	*Degrees*	*Knots*	*Hours*	*Hours*
Bo 22	0.9 mile N. 57° E. of North Rock, Quicks Hole (41°27.5′ N., 70°50.4′ W.).	July 22–25	2½	Pole	6½	[8]										
			2½	Meter	10											
			2½	do	24											
			2½	do	38											
Bo 23	South End of Robinsons Hole (41°26.7′ N., 70°48.2′ W.).	Aug. 10–11	1	Pole	3½	9.00	12.20	162	0.80	6.62	3.20	5.40	339	1.10	5.80	0.01
			1	Meter	3	9.20	0.00		0.70	6.42	3.20	5.10		1.10	6.00	0.04
			1	do	13	9.20	0.20		0.90	6.42	3.20	5.50		0.90	6.00	0.19
Bo 24	Middle of Robinsons Hole (41°27.0′ N., 70°48.4′ W.).	Aug. 10–12	2	Pole	3½	9.40	0.50	146	2.90	5.92	2.90	5.10	316	2.60	6.50	0.14
			2	Meter	5	9.40	0.30		2.80	5.82	2.80	5.00		3.10	6.60	0.04
			2	do	12	9.40	0.10		2.70	6.02	3.00	5.20		2.90	6.40	0.09
			2	do	19	9.30	0.40		2.40	6.02	2.90	4.60		2.40	6.40	12.38
Bo 25	North End of Robinsons Hole (41°27.4′ N., 70°48.7′ W.).	Aug. 11–12	1	Pole	3½	9.80	0.30	161	1.20	5.32	2.70	5.50	338	1.20	7.10	0.24
			1	Meter	4	9.80	0.10		0.70	5.42	2.80	5.80		1.20	7.00	0.29
			1	do	14	9.80	0.50		1.20	5.32	2.70	5.50		1.30	7.10	0.29
Bo 26	0.5 mile N. 40° W. of the western end of Kettle Cove (41°29.0′ N., 70°47.6′ W.).	July 20–22	2	Pole	6½	4.20	9.50	46	0.50	8.42	0.20	2.50	260	0.40	4.00	9.08
			2	Meter	10	4.30	8.50		0.40	8.22	0.10	2.50		0.50	4.20	8.83
			2	do	24	4.30	8.50		0.30	8.32	0.20	2.30		0.50	4.10	8.80
			2	do	38	4.30	8.50		0.30	8.32	0.20	2.00		0.60	4.10	8.73
Bo 27	4.1 miles S. 70° E. of Dumpling Rocks Light (41°30.9′ N., 70°50.1′ W.).	do	2	Pole	6½	5.20	10.00	72	0.50	8.02	0.80	3.00	230	0.40	4.40	9.73
			2	Meter	12	5.30	10.00		0.60	7.92	0.80	2.90		0.60	4.50	9.73
			2	do	30	5.20	9.20		0.50	7.92	0.70	2.80		0.70	4.50	9.45
			2	do	48	5.30	9.20		0.40	7.92	0.80	3.00		0.60	4.50	9.55
Bo 28	3.0 miles N. 73° E. of Dumpling Rocks Light (41°33.2′ N., 70°51.5′ W.).	do	2	Pole	7	4.40	10.20		0.50	8.32	0.30	2.30		0.40	4.10	9.28
			2	Meter	8	4.30	8.40		0.60	8.32	0.20	2.50		0.70	4.10	8.83
			2	do	21	4.30	8.40		0.60	8.42	0.30	2.50		0.70	4.00	8.85
			2	do	34	4.20	8.40		0.60	8.52	0.30	2.20		0.60	3.90	8.75
Bo 29	1.3 miles N. 10° E. of Round Hill Point (41°33.6′ N., 70°55.4′ W.).	Aug. 12–14	2	Pole	6½	5.20	9.00	7	0.30	7.92	0.70	3.00	159	0.10	4.50	9.45
			2	Meter	5	5.20	9.20		0.40	7.92	0.70	3.00		0.30	4.50	9.50
			2	do	12	5.20	9.00		0.40	8.02	0.80	3.00		0.30	4.40	9.48
			2	do	20	5.20	9.00		0.40	7.92	0.70	3.00		0.30	4.50	9.45
Bo 30	1.9 miles N. 33° E. of Dumpling Rocks Light (41°33.9′ N., 70°53.9′ W.).	Aug. 13–15	2	Pole	6½	5.00	10.00	12	0.30	7.72	0.30	2.70	204	0.30	4.70	9.48
			2	Meter	6	5.30	9.00		0.30	7.32	0.20	2.80		0.30	5.10	9.30
			2	do	15	5.30	9.00		0.20	7.32	0.20	2.80		0.30	5.10	9.30
			2	do	24	5.30	9.00		0.20	7.32	0.20	2.50		0.30	5.10	9.23
Bo 31	*1.2 miles S. 64° W. of Sconticut Point (41°34.4′ N., 70°52.6′ W.).*	*Aug. 13–15, Sept. 10–11.*	3½	Pole	7	4.00	9.00	45	0.20	8.82	0.40	2.60	240	0.20	3.60	8.98
			3½	Meter	6	3.70	8.50		0.30	9.02	0.30	2.20		0.30	3.40	8.65
			3½	do	16	3.80	8.50		0.20	8.92	0.30	2.20		0.30	3.50	8.68
			3½	do	26	3.80	8.50		0.20	8.82	0.20	2.00		0.30	3.60	8.60
Bo 32	0.3 mile S. 25° W. of Ricketsons Point (41°34.4′ N., 70°56.5′ W.).	Aug. 12–13	1	Pole	3½	8.10	10.30	321	0.20	4.32	0.00	4.00	139	0.20	8.10	10.58
			1	Meter	4	8.20	10.80		0.30	4.32	0.10	4.00		0.30	8.10	10.75
			1	do	15	8.20	10.50		0.30	4.32	0.10	4.00		0.30	8.10	10.68
Bo 33	0.5 mile N. 86° W. of Clark Point (Old Tower) (41°35.7′ N., 70°54.8′ W.).	July 7–8	1	Pole	7	[1]										
			1	Meter	4											
			1	do	14											
Bo 34	0.3 mile N. 82° E. of Clark Point (Old Tower) (41°35.6′ N., 70°53.7′ W.).	Sept. 9–10–25–26–29	2½	Pole	7	5.70	10.00	18	0.30	7.02	0.30	3.30	164	0.30	5.40	9.80
			2½	Meter	5	5.90	9.50		0.30	6.72	0.20	2.50		0.30	5.70	9.50
			2½	do	13	5.90	9.50		0.30	6.62	0.10	3.00		0.30	5.80	9.60
			2½	do	21	5.90	9.50		0.20	6.62	0.10	3.00		0.30	5.80	9.60
Bo 35	0.9 mile S. 79° E. of Butler Flats Light (41°36.0′ N., 70°52.6′ W.).	Sept. 10–12	2	Pole	6½	7.30	10.00	359	0.20	5.52	0.40	3.80	181	0.20	6.90	10.35
			2	Meter	5	6.80	9.80		0.20	5.82	0.20	3.50		0.20	6.60	10.05
			2	do	12	6.80	9.80		0.20	5.82	0.20	3.50		0.10	6.60	10.05
			2	do	19	6.80	9.80		0.20	5.82	0.20	3.50		0.20	6.60	10.05
Bo 36	0.2 mile N. 26° W. of Butler Flats Light (41°36.4′ N., 70°53.8′ W.).	Aug. 24–25, Sept. 10–11–12–29.	3½	Pole	6½	7.10	9.60	327	0.20	4.90	12.00	3.20	175	0.30	7.52	9.85
			3½	Meter	5–6	7.20	9.60		0.30	4.50	11.70	3.30		0.30	7.92	9.82
			3½	do	13–14, 15	7.20	9.80		0.30	4.50	11.70	3.30		0.30	7.92	9.87
			3½	do	20, 22, 24	7.20	9.80		0.30	4.50	11.70	3.50		0.20	7.92	9.92
Bo 37	0.3 mile S. 48° W. of Palmer Island Light (41°37.4′ N., 70°54.9′ W.).	July 6–7	1	Pole	3½	[1]										
			1	Meter	2											
			1	do	7											
Bo 38	0.2 mile S. 28° E. of Palmer Island Light (41°37.4′ N., 70°54.5′ W.).	Aug. 24–25, Sept. 11–12.	2	Pole	3½	7.80	10.20	346	0.20	4.92	0.30	2.80	174	0.50	7.50	10.25
			2	Meter	3	7.80	10.00		0.30	4.82	0.20	3.00		0.50	7.60	10.23
			2	do	13	7.80	9.80		0.40	4.82	0.20	3.00		0.40	7.60	10.18
Bo 39	East draw, Fairhaven Bridge, New Bedford (41°38.4′ N., 70°55.0′ W.).	July 6–8	2	Pole	6½	7.30	10.80	330	0.30	5.42	0.30	2.80	150	0.40	7.00	10.28
			2	Meter	5	6.70	10.50		0.20	6.12	0.40	3.00		0.40	6.30	10.13
			2	do	13	6.70	10.50		0.30	6.12	0.40	3.00		0.50	6.30	10.13
			2	do	22	6.70	10.00		0.30	6.12	0.40	2.80		0.40	6.30	9.95
Bo 40	1.4 miles N. 20° W. of Palmer Island Light (Upper New Bedford Harbor) (41°38.9′ N., 70°55.2′ W.).	July 9–10	1	Pole	3½	[1]										
			1	Meter	4											
			1	do	14											
Bo 41	60 feet south of center pier, Coggeshall Bridge, New Bedford (41°39.4′ N., 70°55.0′ W.).	do	1	Pole	6½	5.50	9.40	N.[7]	0.30	6.80	12.30	2.40	S.[7]	0.20	5.62	9.27
			1	Meter	3	5.60	9.40		0.40	6.70	12.30	2.80		0.30	5.72	9.40
			1	do	12	5.80	10.00		0.20	7.02	0.40	3.20		0.20	5.40	9.83
Bo 42	0.2 mile S. 17° E. of Weepecket Island (41°30.4′ N., 70°44.3′ W.).	July 22–23	1	Pole	6½	4.20	9.80	69	0.80	8.42	0.20	2.00	255	0.60	4.00	9.03
			1	Meter	12	4.30	9.80		0.80	8.32	0.20	2.00		0.60	4.10	9.05
			1	do	30	4.30	10.00		0.80	8.32	0.20	2.00		0.70	4.10	9.10
			1	do	48	4.30	9.80		0.70	8.32	0.20	1.80		0.60	4.10	9.00
Bo 43	1.1 miles S. 32° E. of West Island (41°34.0′ N., 70°48.6′ W.).	Sept. 8–10	2	Pole	6½	6.80	10.40	79	0.70	5.82	0.20	2.70	203	0.80	6.60	10.00
			2	Meter	6	6.80	10.00		0.70	5.82	0.20	2.80		0.80	6.60	9.93
			2	do	16	6.80	10.00		0.60	5.82	0.20	2.70		0.70	6.60	9.90
			2	do	26	6.80	10.00		0.50	5.92	0.30	2.80		0.50	6.50	9.95
Bo 44	0.9 mile N. 42° E. of Sconticut Point (41°35.6′ N., 70°50.4′ W.).	Sept. 8–10	2	Pole	1	6.00	10.00	[9]	0.20	5.00	11.00	1.30	162	0.40	7.42	8.95
			2	Meter	2	6.50	9.50		0.40	4.30	10.80	1.50		0.50	8.12	8.95

See footnotes at end of table.

Station no.	Observer, location, and year	Observations: Date	Observations: Period	Observations: Method	Observations: Depth	Slack	Flood strength: Time	Flood strength: Direction (true)	Flood strength: Velocity	Flood duration	Slack	Ebb strength: Time	Ebb strength: Direction (true)	Ebb strength: Velocity	Ebb duration	Mean current hour
	G. E. BOOTHE, 1931—Continued		*Days*		*Feet*	*Hours after high water*	*Hours after high water*	*Degrees*	*Knots*	*Hours*	*Hours after high water*	*Hours after high water*	*Degrees*	*Knots*	*Hours*	*Hours*
Bo 45	0.9 mile S. 16° W. of Cormorant Rock Beacon (41°35.5′ N., 70°47.8′ W.).	July 27–29	2	Pole	7	3.90	8.60	32	0.40	8.40	12.30	1.90	185	0.30	4.02	8.55
			2	Meter	7	3.80	8.00		0.50	8.40	12.20	1.70		0.50	4.02	8.30
			2	do	17	3.80	8.00		0.50	8.40	12.20	1.80		0.50	4.02	8.32
			2	do	27	3.80	8.00		0.40	8.40	12.20	1.80		0.40	4.02	8.32
Bo 46	0.7 mile S. 49° E. of Wards Rock (41°37.1′ N., 70°50.2′ W.).	Sept. 24–25	1	Pole	3½	6.10	9.40	294	0.30	6.00	12.10	3.00	133	0.30	6.42	9.52
			1	Meter	4	5.80	9.00		0.30	6.30	12.10	2.80		0.30	6.12	9.30
			1	do	15	5.80	9.00		0.30	6.40	12.20	2.80		0.30	6.02	9.32
Bo 47	0.4 mile S. 61° W. of Wards Rock (41°37.4′ N., 70°51.2′ W.).	Sept. 25–26	1	Pole	1½	5.50	9.20	343	0.20	7.62	0.70	3.00	135	0.20	4.80	9.58
			1	Meter	2	4.70	9.00		0.30	8.72	1.00	3.20		0.40	3.70	9.45
			1	do	6	4.70	9.00		0.30	8.72	1.00	3.20		0.40	3.70	9.45
Bo 48	0.4 mile N. 33° W. of Cormorant Rock Beacon (41°36.6′ N., 70° 47.8′ W.).	Sept. 18–19	1	Pole	6½	5.00	9.40	66	0.40	7.30	12.30	2.00	185	0.70	5.12	9.05
			1	Meter	5	4.80	9.00		0.40	7.40	12.20	2.00		0.40	5.02	8.87
			1	do	12	4.80	8.80		0.40	7.40	12.20	2.00		0.40	5.02	8.82
			1	do	18	4.80	9.00		0.30	7.40	12.20	2.00		0.40	5.02	8.87
Bo 49	0.5 mile S. 76° W. of Nobska Point Light, Woods Hole (41°30.8′ N., 70°39.9′ W.).	Aug. 5–6	1	Pole	3½	7.98	0.48	98	1.30	7.72	3.28	4.68	309	1.10	4.70	12.19
			1	Meter	4	7.98	0.18		1.50	7.72	3.28	5.48		0.80	4.70	12.31
			1	do	14	7.98	0.28		1.20	7.72	3.28	5.18		1.00	4.70	12.26
Bo 50	0.7 mile S. 71° W. of Nobska Point Light, Woods Hole (41°30.7′ N., 70°40.2′ W.).	Aug. 6–8	1½	Pole	6½	8.88	11.78	143	1.40	6.82	3.28	4.18	323	1.20	5.60	12.01
			1½	Meter	5	8.88	12.10		1.30	6.92	3.38	4.48		0.90	5.50	12.19
			1½	do	13	8.88	12.20		1.30	6.92	3.38	4.28		0.90	5.50	12.16
			1½	do	20	8.88	12.30		1.10	6.92	3.38	4.18		1.00	5.50	12.16
Bo 51	0.7 mile S. 89° W. of Nobska Point Light, Woods Hole (41°30.9′ N., 70°40.2′ W.).	Aug. 3–5	2	Pole	6½	7.88	0.28	126	1.60	7.42	2.88	4.48	313	1.40	5.00	11.96
			2	Meter	5	7.88	0.38		1.80	7.52	2.98	4.78		1.10	4.90	12.09
			2	do	13	7.88	0.28		1.70	7.52	2.98	4.48		1.20	4.90	11.99
			2	do	22	7.88	0.68		1.40	7.52	2.98	4.48		1.10	4.90	12.09
Bo 52	0.9 mile N. 64° W. of Nobska Point Light, Woods Hole (41°31.4′ N., 70°40.4′ W.).	Aug. 6–8	1½	Pole	7	7.98	10.88	126	0.40	7.12	2.68	4.68	329	0.60	5.30	11.55
			1½	Meter	6	7.98	10.68		0.50	6.92	2.48	4.68		0.50	5.50	11.45
			1½	do	15	7.98	10.68		0.40	6.92	2.48	4.68		0.70	5.50	11.45
			1½	do	24	7.98	10.48		0.40	6.92	2.48	4.98		0.90	5.50	11.48
Bo 53	1.3 miles N. 79° W. of Nobska Point Light, Woods Hole (41°31.2′ N., 70°41.1′ W.).	Aug. 3–6	3	Pole	3½	8.18	12.40	94	2.70	7.02	2.78	4.78	276	3.60	5.40	12.01
			3	Meter	3	8.28	12.40		3.30	6.92	2.78	4.88		3.60	5.50	12.06
			3	do	9	8.28	12.40		3.40	7.02	2.88	4.78		3.30	5.40	12.06
Bo 53A	Center of entrance, gate of Canso, Woods Hole (41°31.2′ N., 70°40.9′ W.).	Aug. 19	¼	Pole	3½		11.80	N.[7]	2.57		2.48					12.12
			¼	Meter	2		0.18		1.65		2.38					
			¼	do	8		0.18		1.85		2.38					
Bo 54	*2.1 miles S. 83° W. of Nobska Point Light, Woods hole (41°30.7′ N., 70°42.1′ W.).*	*Sept. 18–19*	*1*	Pole	*3½*	*8.00*	*11.30*	*206*	*0.50*	*7.32*	*2.90*	*5.50*	*36*	*0.40*	*5.10*	*11.90*
			1	Meter	3	7.40	11.50		0.40	8.22	3.20	5.50		0.30	4.20	11.88
			1	do	12	7.50	11.50		0.40	8.12	3.20	5.50		0.30	4.30	11.90
Bo 55	0.4 mile N. 55° E. of Uncatena Island, Woods hole (41°31.5′ N., 70°41.6′ W.).	Aug. 3–5	2	Pole	6½	7.28	12.30	160	0.90	8.22	3.08	4.18	7	0.80	4.20	11.69
			2	Meter	5	7.48	12.20		0.80	7.92	2.98	4.38		0.60	4.50	11.74
			2	do	14	7.48	11.88		0.80	7.92	2.98	4.18		0.80	4.50	11.61
			2	do	22	7.48	12.30		0.70	7.92	2.88	4.48		0.60	4.50	11.76
Bo 56	1.7 miles N. 46° E. of Weepecket Island (41°32.0′ N., 70°42.8′ W.).	Aug. 5–8	2½	Pole	6½	5.58	10.58	94	0.50	8.22	1.38	3.58	209	0.50	4.20	10.26
			2½	Meter	8	5.48	9.68		0.50	8.22	1.28	3.48		0.60	4.20	9.96
			2½	do	21	5.48	9.68		0.40	8.32	1.38	3.58		0.50	4.10	10.01
			2½	do	34	5.48	9.48		0.50	8.32	1.38	3.68		0.50	4.10	9.98
Bo 57	Center of entrance, Quamquisset Harbor (41°32.4′ N., 70°39.8′ W.).	Sept. 17–18	1	Pole	3½	3.40	6.50	129	0.40	6.60	10.00	1.50	43	0.30	5.82	7.22
			1	Meter	2	3.20	6.50		0.40	6.50	9.70	1.20		0.30	5.92	7.02
			1	do	9	3.20	6.00		0.40	6.60	9.80	1.50		0.30	5.82	7.00
Bo 58	1.1 miles N. 08° W. of Long Neck (41°33.1′ N., 70°41.2′ W.).	July 27–29	2	Pole	6½	4.80	9.20	67	0.40	8.82	1.20	3.00	161	0.20	3.60	9.53
			2	Meter	9	4.70	9.00		0.50	8.92	1.20	3.00		0.30	3.50	9.45
			2	do	23	4.70	9.00		0.50	8.92	1.20	3.00		0.30	3.50	9.45
			2	do	37	4.70	9.00		0.50	8.92	1.20	3.00		0.30	3.50	9.45
Bo 59	3.5 miles N. 01° E. of Weepecket Island (41°34.3′ N., 70°44.1′ W.).	do	2	Pole	6½	4.80	9.50	53	0.40	8.32	0.70	2.70	191	0.40	4.10	9.40
			2	Meter	9	4.80	9.00		0.40	8.32	0.70	2.80		0.50	4.10	9.30
			2	do	22	4.80	9.00		0.50	8.32	0.70	2.80		0.50	4.10	9.30
			2	do	34	4.80	9.00		0.50	8.32	0.70	2.80		0.50	4.10	9.30
Bo 60	Center of entrance West Falmouth Harbor (41°36.5′ N., 70° 39.3′ W.).	July 31–Aug. 1	1	Pole	3½	[1]										
			1	Meter	3											
			1	do	12											
Bo 61	2.0 miles S. 54° W. of Nyes Neck (41°37.1′ N., 70°41.4′ W.).	July 29–31	2	Pole	7	[1]										
			2	Meter	8											
			2	do	20											
			2	do	31											
Bo 62	1.9 miles S. 73° E. of Angelica Point (41°37.9′ N., 70°43.5′ W.).	do	2	Pole	6½	4.60	9.00	29	0.40	8.62	0.80	2.80	196	0.40	3.80	9.28
			2	Meter	6	5.30	9.20		0.50	7.82	0.70	3.00		0.50	4.60	9.53
			2	do	16	5.30	9.20		0.50	7.82	0.70	3.00		0.40	4.60	9.53
			2	do	25	5.30	9.20		0.50	7.82	0.70	3.00		0.40	4.60	9.53
Bo 63	0.6 mile S. 67° E. of Angelica Point (41°38.3′ N., 70° 45.3′ W.).	do	2	Pole	6½	4.80	9.00	56	0.60	8.32	0.70	2.20	166	0.50	4.10	9.15
			2	Meter	9	4.80	9.00		0.50	8.22	0.60	2.80		0.50	4.20	9.28
			2	do	14	4.80	9.00		0.50	8.42	0.80	2.80		0.40	4.00	9.33
			2	do	22	4.80	9.00		0.40	8.52	0.90	2.80		0.30	3.90	9.35
Bo 64	1.3 miles S. 27° W. of Angelica Point (41°37.3′ N., 70° 46.7′ W.).	Sept. 18–19	1	Pole	6½	[1]										
			1	Meter	4											
			1	do	11											
			1	do	18											
Bo 65	0.8 mile S. 10° E. of Ned Point Light (41°38.2′ N., 70° 47.6′ W.).	July 31–Aug. 1	1	Pole	6½	[1]										
			1	Meter	5											
			1	do	11											
			1	do	18											
Bo 66	0.9 mile S. 60° E. of Ned Point Light (41°38.6′ N., 70°46.7′ W.).	do	1	Pole	3½	[1]										
			1	Meter	5											
			1	do	11											
			1	do	17											

See footnotes at end of table.

TABLE 5.—*Current Data, Buzzards Bay—Continued*

Station no.	Observer, location, and year	Observations				Slack	Flood strength			Flood duration	Slack	Ebb strength			Ebb duration	Mean current hour
		Date	Period	Method	Depth		Time	Direction (true)	Velocity			Time	Direction (true)	Velocity		
	G. E. BOOTHE, 1931—Continued.		*Days*		*Feet*	*Hours after high water*	*Hours after high water*	*Degrees*	*Knots*	*Hours*	*Hours after high water*	*Hours after high water*	*Degrees*	*Knots*	*Hours*	*Hours*
Bo 67	0.2 mile W. of Nyes Neck (41°38.3′ N., 70°39.5′ W.).	Aug. 19–21	2	Pole	7	6.90	10.70	345	0.30	5.30	12.20	2.20	200	0.50	7.12	9.87
			2	Meter	7	6.80	9.50		0.30	5.40	12.20	2.00		0.50	7.02	9.50
			2	do	18	6.80	9.50		0.30	5.40	12.20	3.00		0.30	7.02	9.75
			2	do	29	6.70	9.50		0.30	5.50	12.20	2.50		0.30	6.92	9.60
Bo 68	2.0 miles S. 11° E. of Wings Neck Light (41°38.8′ N., 70°39.2′ W.).	Aug. 20–21	1	Pole	6½	(1)										
			1	Meter	4											
			1	do	14											
Bo 69	0.8 mile S. 73° E. of Seal Rocks, Cataumet Harbor (41°39.3′ N., 70°38.4′ W.).	do	1	Pole	6½	(1)										
			1	Meter	4											
			1	do	14											
Bo 70	1.2 miles S. 55° E. of Bird Island Light (41°39.5′ N., 70°41.8′ W.).	Aug. 17–20	3	Pole	6½	8.60	11.00	40	0.30	4.12	0.30	3.00	184	0.50	8.30	10.70
			3	Meter	8	8.70	10.80		0.30	3.92	0.20	4.00		0.40	8.50	10.90
			3	do	20	8.70	10.90		0.30	3.92	0.20	4.50		0.30	8.50	11.05
			3	do	32	8.70	10.90		0.30	3.92	0.20	4.50		0.20	8.50	11.05
Bo 71	0.3 mile S. 69° E. of Bird Island Light (41°40.1′ N., 70°42.7′ W.).	Aug. 17–19	2	Pole	7	5.20	10.60	64	0.50	7.42	0.20	2.30	182	0.60	5.00	9.55
			2	Meter	5	5.30	10.80		0.60	7.32	0.20	2.50		0.70	5.10	9.68
			2	do	12	5.30	10.60		0.50	7.32	0.20	2.20		0.60	5.10	9.55
			2	do	19	5.30	10.00		0.40	7.32	0.20	2.80		0.40	5.10	9.55
Bo 72	1.0 mile N. 72° W. of Bird Island Light (41°40.5′ N., 70°44.3′ W.).	Sept. 16–18	1½	Pole	3½	5.60	9.50	4	0.40	7.22	0.40	2.70	172	0.40	5.20	9.53
			1½	Meter	4	5.80	9.50		0.30	6.82	0.20	3.00		0.40	5.60	9.60
			1½	do	14	5.80	9.50		0.30	6.82	0.20	3.00		0.30	5.60	9.60
Bo 73	0.4 mile S. 76° W. of Meadows Island, Sippican Harbor (41°41.8′ N., 70°45.2′ W.).	do	1½	Pole	3¾	5.80	10.00	332	0.20	7.62	1.00	2.50	158	0.40	4.80	9.80
			1½	Meter	4	5.80	10.00		0.30	6.82	0.20	2.40		0.40	5.60	9.58
			1½	do	15	5.80	10.00		0.30	6.82	0.20	2.50		0.40	5.60	9.60
Bo 74	1.2 miles S. 66° E. of Wings Neck Light (41°40.4′ N., 70°38.3′ W.).	Sept. 15–16	1	Pole	1½	7.00	10.50	111	0.20	5.00	12.00	2.80	292	0.60	7.42	9.95
			1	Meter	2	5.70	9.20		0.30	6.50	12.20	2.80		0.70	5.92	9.35
			1	do	6	5.70	9.00		0.20	6.50	12.20	2.70		0.70	5.92	9.27
Bo 75	Center of entrance, Pocasset Harbor (41°40.9′ N., 70°38.6′ W.).	do	1	Pole	3½	5.30	10.00	35	0.70	7.22	0.10	2.60	215	0.90	5.20	9.48
			1	Meter	3–4	5.30	10.00		0.60	7.32	0.20	2.50		0.70	5.10	9.48
			1	do	11–12	5.30	9.60		0.80	7.32	0.20	2.60		0.80	5.10	9.40
Bo 76	Center of channel, north entrance, Red Brook Harbor (41°41.1′ N., 70°37.8′ W.).	Sept. 15–17	1½	Pole	3½	4.80	10.00	181	0.50	8.12	0.50	3.30	341	0.30	4.30	9.63
			1½	Meter	1–2	4.80	9.50		0.50	7.82	0.20	3.20		0.40	4.60	9.40
			1½	do	4–7	4.80	9.70		0.50	7.82	0.20	3.20		0.40	4.60	9.45
Bo 77	*0.4 mile N. 63° W. of Wings Neck Light (41°41.0′ N., 70°40.2′ W.).*	*Aug. 17–20*	3	Pole	6½	5.80	10.60	354	0.50	7.02	0.40	3.00	221	0.50	5.40	9.93
			3	Meter	4	5.70	10.00		0.40	6.92	0.20	3.20		0.60	5.50	9.75
			3	do	11	5.70	10.00		0.50	6.92	0.20	2.70		0.60	5.50	9.63
			3	do	17	5.70	10.80		0.50	6.92	0.20	2.70		0.50	5.50	9.83
Bo 78	0.5 mile N. 34° E. of Great Hill Point (41°42.5′ N., 70°42.5′ W.).	Sept. 14–15	1	Pole	3½	7.20	10.00	12	0.30	5.42	0.20	3.80	(10)	0.30	7.00	10.28
			1	Meter	4	7.20	10.50		0.40	5.42	0.20	3.20		0.60	7.00	10.25
			1	do	11	7.20	10.00		0.40	5.42	0.20	3.50		0.50	7.00	10.20
			1	do	17	7.20	10.20		0.30	5.42	0.20	3.50		0.40	7.00	10.25
Bo 79	0.6 mile N. 19° E. of Cromeset Point (41°44.0′ N., 70°43.0′ W.).	do	1	Pole	3¾	5.80	10.30	22	0.60	6.92	0.30	3.00	202	0.60	5.50	9.83
			1	Meter	3	5.80	10.50		0.60	6.92	0.30	3.00		0.70	5.50	9.88
			1	do	11	5.90	10.40		0.50	6.82	0.30	3.20		0.60	5.60	9.93
Bo 80	Center of channel, west of Barneys Point (41°44.7′ N., 70°42.4′ W.).	do	1	Pole	3½	5.50	10.50	10	0.70	7.22	0.30	2.80	185	0.60	5.20	9.75
			1	Meter	3	5.80	10.50		0.70	6.92	0.30	3.00		0.70	5.50	9.88
			1	do	10	5.80	10.40		0.80	6.92	0.30	3.00		0.60	5.50	9.85
Bo 81	0.5 mile S.52° W. of Stony Point, Great Neck (41°42.7′ N., 70°39.7′ W.).	Aug. 28–29	1	Pole	3½	4.80	9.00	77	0.20	8.02	0.40	2.40	268	0.30	4.40	9.13
			1	Meter	3	5.30	9.00		0.30	7.72	0.60	2.60		0.40	4.70	9.35
			1	do	9	5.30	9.40		0.30	7.72	0.60	2.80		0.40	4.70	9.50
Bo 82	0.6 mile S. 18° E. of Mashnee Island (41°42.3′ N., 70°37.8′ W.).	Aug. 24–27	3	Pole	3½	6.70	10.90	24	0.20	7.22	1.50	3.30	191	0.30	5.20	10.58
			3	Meter	3	5.20	10.00		0.40	8.92	1.70	3.50		0.40	3.50	10.08
			3	do	11	5.20	10.00		0.40	8.92	1.70	3.30		0.40	3.50	10.03
Bo 83	0.5 mile S. 38° E. of Hog Island (41°43.0′ N., 70°37.6′ W.).	Aug. 27–29	2	Pole	6½	6.20	9.50	33	0.70	7.22	1.00	3.60	232	0.80	5.20	10.05
			2	Meter	4	6.40	9.80		0.80	7.22	1.20	3.50		0.80	5.20	10.20
			2	do	11	6.40	10.60		0.60	7.22	1.20	3.40		0.70	5.20	10.38
Bo 84	0.1 mile E. of Cedar Point, Great Neck (41°43.1′ N., 70°38.8′ W.).	Aug. 27–28	1	Pole	3½	5.90	9.70	18	0.40	7.52	1.00	3.30	215	0.50	4.90	9.95
			1	Meter	3	5.40	10.00		0.40	8.12	1.10	3.50		0.40	4.30	9.98
			1	do	9	5.40	9.80		0.50	8.12	1.10	3.00		0.50	4.30	9.80
Bo 85	West edge of channel, east of Hog Island (41°43.4′ N., 70°37.8′ W.).	Aug. 25–27	2	Pole	6½	7.70	10.00	14	0.60	5.42	0.70	3.50	166	0.70	7.00	10.45
			2	Meter	5	7.80	10.00		0.60	5.42	0.80	3.50		0.70	7.00	10.50
			2	do	14	7.90	10.30		0.70	5.32	0.80	3.60		0.80	7.10	10.63
			2	do	22	7.90	10.80		0.70	5.32	0.80	4.40		0.70	7.10	10.95
Bo 86	Center of channel, between Hog Neck and Hog Island (41°43.5′ N., 70°28.5′ W.).	Sept. 4–5	1	Pole	3½	6.50	10.30	327	1.30	6.42	0.50	3.20	168	2.20	6.00	10.10
			1	Meter	5	7.20	10.30		1.30	5.92	0.70	3.10		1.80	6.50	10.30
			1	do	12	7.20	11.10		1.40	6.02	0.80	2.80		1.80	6.40	10.45
			1	do	18	7.20	10.70		1.30	6.02	0.80	3.00		1.60	6.40	10.40
Bo 87	0.1 mile N. 12° W. of Burgess Point, Onset Bay (41°43.9′ N., 70°38.7′ W.).	Sept. 3–4	1	Pole	3½	5.20	9.00	298	0.60	7.72	0.50	3.20	130	1.00	4.70	9.45
			1	Meter	2	5.20	9.00		0.50	7.92	0.70	3.50		1.00	4.50	9.58
			1	do	9	5.10	9.20		0.70	8.02	0.70	2.90		0.80	4.40	9.45
Bo 88	0.1 mile south of Wickets Island Onset Bay (41°44.1′ N., 70°39.3′ W.).	Sept. 3–5	1½	Pole	3½	(1)										
			1½	Meter	2											
			1½	do	7											
Bo 89	0.4 mile S. 42° E. of Sears Point (41°43.8′ N., 70°37.8′ W.).	Aug. 25–28	3	Pole	3½	7.60	11.00	356	0.90	6.22	1.40	4.50	185	1.70	6.20	11.10
			3	Meter	3	7.30	10.80		1.10	6.82	1.70	4.50		1.90	5.60	11.05
			3	do	13	7.40	11.00		1.00	6.72	1.70	4.50		1.60	5.70	11.13
Bo 90	0.1 mile S. 82° E. of Sears Point (41°44.0′ N., 70°38.0′ W.).	Aug. 28–29, Aug. 31–Sept. 1.	2	Pole	3½	6.00	9.80	15	0.80	7.52	1.10	3.70	167	0.90	4.90	10.13
			2	Meter	2	6.20	10.00		0.90	7.42	1.20	3.80		1.00	5.00	10.28
			2	do	7	6.20	10.50		0.80	7.42	1.20	3.70		0.80	5.00	10.38
Bo 91[1]	Highway bridge, Buttermilk Bay (41°44.8′ N., 70°37.3′ W.)	Sept. 2–3	1	Pole	3½	5.80	10.50	E.[7]	1.20	7.32	0.70	3.40	W.[7]	2.30	5.10	10.08
			1	Meter	3	5.80	10.50		1.30	7.22	0.60	3.50		2.30	5.20	10.08
			1	do	10	5.80	10.40		1.00	7.22	0.60	3.40		2.20	5.20	10.03

See footnotes at end of table.

Table 5.—*Current Data, Buzzards Bay—Continued*

Station no.	Observer, location, and year	Observations: Date	Period	Method	Depth	Slack	Flood strength: Time	Direction (true)	Velocity	Flood duration	Slack	Ebb strength: Time	Direction (true)	Velocity	Ebb duration	Mean current hour
			Days		*Feet*	*Hours after high water*	*Hours after high water*	*Degrees*	*Knots*	*Hours*	*Hours after high water*	*Hours after high water*	*Degrees*	*Knots*	*Hours*	*Hours*
	G. E. BOOTHE, 1931—Continued.															
Bo 92	N. Y., N. H. H. & R. R. bridge, Cape Cod Canal (41°44.5′ N., 70°36.8′ W.)	Aug. 31, Sept. 2	2	Pole	3½	7.35	10.45	E.	2.90	6.50	1.43	4.15	W.	3.30	5.92	10.82
			2	Meter	5	7.25	10.25		2.70	6.60	1.43	3.95		3.50	5.82	10.70
			2	do	12	7.25	10.25		2.60	6.60	1.43	3.95		3.50	5.82	10.70
			2	do	19	7.25	10.25		2.30	6.60	1.43	4.05		3.30	5.82	10.72
Bo 93	Bourne Highway Bridge, Cape Cod Canal (41°44.8′ N., 70°35.8′W.).	Sept. 1–5	3½	Pole	3½	7.45	10.45	E.	3.50	6.80	1.83	4.25	W.	3.60	5.62	10.97
			3½	Meter	5	7.25	10.65		3.30	7.00	1.83	4.45		4.20	5.42	11.02
			3½	do	12	7.25	10.65		3.20	7.00	1.83	4.35		4.10	5.42	11.00
			3½	do	19	7.25	10.65		2.90	7.00	1.83	4.35		4.00	5.42	11.05
Bo 94	Sagamore Bridge, Cape Cod Canal (41°46.5′ N., 70°32.0′ W.)	Aug. 31, Sept. 1–2	2	Pole	6½	7.25	10.45	E.	2.90	6.70	1.53	4.45	W.	2.60	5.72	10.90
			2	Meter	7	7.35	10.25		2.80	6.90	1.83	4.05		2.40	5.52	10.85
			2	do	17	7.35	9.65		2.70	6.90	1.83	3.55		2.60	5.52	10.57
			2	do	28	7.35	9.85		2.30	6.90	1.83	3.65		2.60	5.52	10.65
	U. S. ENGINEERS, CAPE COD CANAL, 1932 [12]															
E 45	41°46.4′ N., 70°30.6′ W	Oct. 6	½	do	8.6	7.10		E.[7]	2.01	7.15	1.83	4.13	W.[7]	2.01	5.27	10.90
				do	20.2	7.10		E.	2.02	7.15	1.83	4.23	W.	2.32	5.27	10.94
E 80	41°46.4′ N., 70°31.5′ W	Oct. 5–6	1	do	8.4	7.35	10.90	E.	3.23	6.95	1.88	4.03	W.	2.87	5.47	11.04
				do	19.6	7.35	10.90	E.	3.08	6.95	1.88	4.03	W.	3.17	5.47	11.04
E 125	41°46.6′ N., 70°32.4′ W	Oct. 4–5	1	do	8.0	7.60	10.70	E.	3.56	6.60	1.78	4.08	W.	2.94	5.82	11.04
				do	18.6	7.60	10.70	E.	3.21	6.60	1.78	4.08	W.	3.00	5.82	11.04
E 172	41°46.5′ N., 70°33.3′ W	Oct. 3–4	1	do	8.9	7.50	10.20	E.	3.18	6.80	1.88	4.18	W.	2.88	5.62	10.94
				do	20.7	7.50	10.30	E.	2.84	6.80	1.88	4.23	W.	3.04	5.62	10.98
E225[5]	41°46.1′ N., 70°34.0′ W	Sept. 28–Oct. 6	8	do	10.5	7.42	10.74	E.	3.68	6.73	1.73	4.09	W.	3.61	5.69	10.99
				do	24.6	7.44	10.80	E.	3.13	6.72	1.74	4.01	W.	3.44	5.70	11.00
E 275	41°45.2′ N., 70°34.8′ W	Oct. 2–3	½	do	10.6	7.45	10.70	E.	3.07	6.90	1.93	4.53	W.	3.69	5.52	11.15
				do	24.7	7.45	10.70	E.	2.72	6.90	1.93	4.23	W.	3.40	5.52	11.08
E 325	41.44.8′ N., 70°35.7′ W	Oct. 1–2	1	do	8.9	7.65	10.70	E.	3.64	6.70	1.93	4.13	W.	3.99	5.72	11.10
				do	20.8	7.65	10.85	E.	3.08	6.70	1.93	4.13	W.	3.59	5.72	11.14
E 375	41°44.6′ N., 70°36.7′ W	Sept. 29	½	do	8.0	7.60	10.40	E.	2.41	6.65	1.83	4.53	W.	3.30	5.77	11.09
				do	18.0	7.60	10.40	E.	2.92	6.65	1.83	4.53	W.	3.16	5.77	11.09
E 400	41°44.3′ N., 70°37.3′ W	Sept. 29–30	½	do	8.0	8.00	10.70	E.	1.47	5.85	1.43	4.63	W.	2.56	6.57	11.19
				do	18.6	8.00		E.	1.62	5.85	1.43	4.63	W.	2.39	6.57	11.24
E 410	41°44.3′ N., 70°37.5′ W	Sept. 30–Oct. 1	1	do	7.8	7.70	10.90	E.	1.49	6.15	1.43	4.13	W.	2.38	6.27	11.06
				do	18.2	7.70	10.75	E.	1.72	6.15	1.43	4.13	W.	2.28	6.27	11.00

[1] *Current weak and irregular.*
[2] *Velocities from the 1913 series are considered more reliable than those from the 1930–31 series.*
[3] Time of minimum current. Directions and velocities of minimum currents are as follows:

Series	Minimum before flood: Direction	Minimum before flood: Velocity	Minimum before ebb: Direction	Minimum before ebb: Velocity
	Degrees	*Knots*	*Degrees*	*Knots*
1913	305	0.05	140	0.31
1930–31	317	0.06	138	0.26

[4] *These stations were also occupied by the United States engineers in 1932. They are designated by the letter E in fig. 30. (See p. 51.)*
[5] Station 225 was occupied by Parsons in 1915; Ritter in 1915; and the United States engineers in 1932.
[6] Meter observations at surface in center of Cape Cod Canal.
[7] E.=eastward; W.=westward; S.=southward; N.=northward.
[8] Current irregular in velocity and direction. Observed velocities between 0.1 and 1.0 knot.
[9] *Directions very irregular due to weak current.*
[10] Ebb direction indefinite.
[11] Flood current irregular.
[12] These stations were also occupied by W. B. Parsons in 1915.

For reference to above table see pp. 51 and 52.

TABLE 6.—*Currents, Hen and Chickens Lightship*

Hours after high water at Clark Point.	Series							
	3 months, 1913				17 months, 1930–31			
	Observed current		Tidal current		Observed current		Tidal current	
	Velocity	True direction	Velocity	True direction	Velocity	True direction	Velocity	True direction
	Knots	*Degrees*	*Knots*	*Degrees*	*Knots*	*Degrees*	*Knots*	*Degrees*
0	0.40	95	0.35	78	0.32	90	0.27	77
1	0.32	144	0.20	139	0.26	135	0.17	137
2	0.43	185	0.33	195	0.29	183	0.25	198
3	0.53	208	0.48	219	0.40	207	0.39	220
4	0.59	215	0.53	227	0.44	217	0.44	230
5	0.42	223	0.39	241	0.32	228	0.34	244
6	0.26	235	0.27	261	0.18	243	0.23	265
7	0.11	267	0.16	298	0.07	275	0.16	295
8	0.10	345	0.21	348	0.08	0	0.15	334
9	0.32	47	0.37	28	0.20	42	0.21	16
10	0.53	57	0.55	45	0.37	54	0.36	40
11	0.59	64	0.60	52	0.44	65	0.42	54
12	0.45	82	0.43	68	0.40	73	0.37	61

Velocities from the 1913 series are considered more reliable than those from the 1930–31 series.
For reference to above table, see p. 52.

TABLE 7.—*Nontidal Current by Months, Hen and Chickens Lightship*

Date	Velocity	True direction	Date	Velocity	True direction
1913	*Knots*	*Degrees*	**1931**	*Knots*	*Degrees*
			January	0.13	98
Sept. 20–Oct. 18	0.15	183	February	0.11	144
Oct. 19–Nov. 16	0.10	130	March	0.15	186
Nov. 17–Dec. 15	0.15	139	April	0.09	130
			May	0.05	129
1930			June	0.11	176
August	0.07	117	July	0.05	166
September	0.08	111	August	0.08	189
October	0.08	152	September	0.10	149
November	0.09	94	October	0.11	102
December	0.11	117	November	0.10	100
			December	0.15	113

Nontidal current from 3-month series, 1913, velocity 0.12 knot, true direction 153°.
Nontidal current from 17-month series, 1930–31, velocity 0.09 knot, true direction 131°.
Velocities from the 1913 series are considered more reliable than those from the 1930–31 series.
For reference to above table, see p. 53.

TABLE 8.—*Current Harmonic Constants, Hen and Chickens Lightship*

Constituent	Sept. 20–Dec. 15, 1913 (87 days)						Sept. 1–Nov. 26, 1930 (87 days)					
	North component (magnetic)			East component (magnetic)			North component (magnetic)			East component (magnetic)		
	Velocity	Epoch		Velocity	Epoch		Velocity	Epoch		Velocity	Epoch	
	H	Local (κ)	Greenwich	H	Local (κ)	Greenwich	H	Local (κ)	Greenwich	H	Local (κ)	Greenwich
	Knots	*Degrees*	*Degrees*	*Knots*	*Degrees*	*Degrees*	*Knots*	*Degrees*	*Degrees*	*Knots*	*Degrees*	*Degrees*
K_1	0.007	57	128	0.050	31	102	0.012	208	279	0.013	4	75
M_2	0.309	137	279	0.491	180	322	0.194	143	285	0.310	180	322
M_4	0.051	31	315	0.074	45	329	0.024	42	326	0.057	68	352
M_6	0.006	145	211	0.021	131	197	0.023	159	225	0.024	136	202
N_2	0.067	122	264	0.121	152	295	0.036	100	242	0.099	155	297
O_1	0.035	15	86	0.048	15	86	0.024	42	113	0.018	42	113
S_2	0.064	135	277	0.107	181	323	0.045	163	305	0.067	192	334

Epochs apply to the times of maximum flow in a north or east direction.
The local epochs refer to the local meridian, Greenwich epochs to the Greenwich meridian.
The magnetic variation was 12° west in 1913 and 14° west in 1930.
Velocities from the 1930 series are generally smaller than those from the 1913 series. Those from the earlier series are considered more reliable.
For reference to above table, see p. 53.

TABLE 9.—*Current Harmonic Constants, Station E 225, Cape Cod Canal*

[Sept. 28–Oct. 6, 1932, 8 days]

Constituent	Velocity	Epoch		Constituent	Velocity	Epoch	
	H	Local (κ)	Greenwich		H	Local (κ)	Greenwich
	Knots	*Degrees*	*Degrees*		*Knots*	*Degrees*	*Degrees*
K_1	0.326	27	97	M_8	0.102	1	206
M_2	3.388	180	322	N_2	0.760	151	292
M_4	0.286	145	68	O_1	0.116	325	36
M_6	0.466	25	88	S_2	0.548	217	358

Epochs apply to the eastward strengths of the several constituents.
The local epochs refer to the local meridian, Greenwich epochs to the Greenwich meridian.
For reference to above table, see p. 53.

Part III—NANTUCKET AND VINEYARD SOUNDS

INTRODUCTION

Nantucket and Vineyard Sounds form a continuous waterway which separates the islands of Nantucket and Marthas Vineyard from Cape Cod and the Elizabeth Islands. This waterway extends from Monomoy Point at the eastern entrance of Nantucket Sound to Cuttyhunk Island at the western extremity of Vineyard Sound, a distance of 43 nautical miles. Its width varies from 3 to 22 miles. Numerous sandy shoals are distributed over the area with channels and passageways between. The bottom is generally sandy with some rocky ledges and boulders along the shores. The sounds are navigable throughout their length for vessels having drafts up to 30 feet and much coastwise shipping passes through them.

The tidal movements of the Atlantic have direct access to Nantucket and Vineyard Sounds through three main passageways; from the east between Monomoy and Nantucket Islands, from the south between Nantucket and Marthas Vineyard Islands, and from the west between Marthas Vineyard and Cuttyhunk Islands. There are four passages connecting with Buzzards Bay which are mentioned on page 48 of this volume.

In addition to the currents in Nantucket and Vineyard Sounds proper, those in their immediate approaches and in the navigable river and harbor entrances are included in this discussion. Results from observational series less than one-half day in length are not included, and results given for stations in the approaches are limited to those derived from long series of observations at lightships and those from a current survey made in 1934. Currents in the passages connecting Vineyard Sound with Buzzards Bay are included in part II of this publication.

The currents which flow through Nantucket and Vineyard Sounds form a small part of the enormous inflow and outflow which accompany the rise and fall of the tide in the Gulf of Maine. This gulf has an area of about 36,000 square miles and a tidal rise and fall varying from 5 feet at Georges Shoal on its southern border to 40 feet in the upper end of the Bay of Fundy which forms the northeastern extension. The volume of water, which during every 6-hour period of rise or fall flows over the curved line of shoals extending from Cape Sable to southeastern Massachusetts, is estimated to be approximately 60 cubic miles. A maximum velocity of from 1 to 2 knots over the entire length of this southern rim of the gulf and throughout Nantucket and Vineyard Sounds accompanies the flow at each rise or fall of the tide.

Through Nantucket and Vineyard Sounds the flood current moves eastward and the ebb current westward. Although the time of a given phase of the tidal current in the sounds varies somewhat from place to place, on the average the flood reaches its strength midway between the times of low water and high water in the Gulf of Maine and the strength of the ebb comes midway between the times of high water and low water in the gulf. The slack waters or periods of minimum current occur near the times of maximum and minimum heights of the tide in the gulf.

In Vineyard Sound and the western end of Nantucket Sound, the currents are for the most part of the reversing type, that is, the change from flood to ebb or ebb to flood is effected by a reversal of direction, a period of slack water preceding and following each flood or ebb.

In the more open waters of Nantucket Sound and its eastern approaches, the rotary type of tidal current, with its direction of flow shifting continuously to the right and no period of slack water, is more or less in evidence at the various current stations.

As the methods employed in the observation, reduction, and presentation of the current data for Nantucket and Vineyard Sounds closely parallel those used in connection with similar data for Narragansett and Buzzards Bays discussed in parts I and II of this publication, frequent references will be made to parts I and II to avoid the repetition of various statements and explanations.

OBSERVATIONS

For nearly a century, observational records of current measurements made in Nantucket and Vineyard Sounds have been accumulating. The earliest of these records was secured by G. S. Blake in the year 1844 when two half-day stations were occupied in the western end of Vineyard Sound. Observations were taken at the surface and at one subsurface depth.

In 1846–47, C. H. Davis observed surface currents at various locations in Nantucket Sound. Series of one day or less were secured at each location.

During the period 1850–53, M. Woodhull measured surface and subsurface currents at a number of stations distributed over both sounds. The usual length of series at each station was 1 day.

In 1852, C. H. McBlair occupied two half-day stations eastward of Chappaquiddick Island.

In 1857, H. Mitchell observed surface currents for periods of from one-half day to 2 days at a large number of locations scattered over Nantucket and Vineyard Sounds. He also obtained observations in the general vicinity of East Chop in 1863 and 1871 and in Edgartown Harbor in 1871.

In 1886, J. M. Hawley secured a day of observations in Edgartown Harbor. In 1891, H. L. Marindin observed at a number of stations in Edgartown Harbor and Katama Bay.

Through a cooperative arrangement with the Bureau of Lighthouses, long series of continuous hourly observations of the velocity and direction of the current have been secured at a number of lightships in the sounds and their immediate approaches. The names of the lightships at which such observations have been made are listed below together with the length of each series and the year it was obtained.

Lightship	Series		Lightship	Series	
	Length	Year		Length	Year
	Days			*Days*	
Vineyard Sound	87	1913	Stone Horse Shoal (old position)	255	1918–19
Do	510	1930–31	Stone Horse Shoal (new position)	[1] 535	1934–36
Hedge Fence	87	1913	Great Round Shoal	87	1911
Cross Rip	87	1913	Pollock Rip (old position)	87	1911
Do	385	1934–35	Pollock Rip Slue	87	1911
Handkerchief	87	1911	Do	900	1918–21
Do	390	1934–35	Pollock Rip (new position)	388	1934–35
Shovelful Shoal	87	1913			

[1] Still in progress (June 1936).

Continuing the program of securing detailed current information in the important waterways of the United States, the field work of a comprehensive current survey of Nantucket and Vineyard Sounds was executed in 1934 by a party in charge of E. F. Hicks. This party secured observations at 47 selected locations, the series at each location, with a few exceptions, covering a period of 3 days. At each location observations were taken at the surface and at several subsurface depths.

METHODS OF OBSERVING

The apparatus and methods used in measuring the velocities and directions of the currents in Nantucket and Vineyard Sounds were in general the same as those described in part I of this publication and reference is made to pages 17 and 18 for an explanation of methods employed and descriptions of the current pole and the Price current meter. The terms "log", "float", and "can" which are used in connection with some of the early observations refer to floats of various kinds with graduated lines attached for measuring the current. Before the current meter came into general use, currents below the surface were measured by means of two cans connected by a wire. One can was submerged and the other allowed to float on the water surface with current line attached.

The current pole used in taking observations at the lightships was 15 feet long and floated with 1 foot of its length above the water surface. It thus measured the average current for the first 14 feet of depth. A pole of the same length was used in connection with the 1934 observations of Hicks except at a few stations where shallow water made a shorter pole necessary.

At stations in the vicinity of Edgartown, where slack waters only were observed, it appears that the times of slack were determined by watching the movements of the water surface or of floating objects thereon.

METHODS OF REDUCING THE OBSERVATIONS

REVERSING CURRENTS

As the currents in Nantucket and Vineyard Sounds are mainly of the reversing type, the major part of the observational material has been subjected to the reduction process usually applied to currents of that type. This process as applied to observations taken at Brenton Reef Lightship is outlined on page 18, part I. With some variations in minor details, all the observations taken in this area prior to 1911 and most of the more recent series have been treated in the manner there described.

ROTARY CURRENTS

For a number of the 1934 stations where the tendency of the current to rotate was more or less pronounced, the half-hourly observed velocities and directions were tabulated in groups referred to the times of tide at a reference station, as explained for the 1931 observations in Buzzards Bay on page 50, part II.

An average velocity for each depth and an average direction for the pole observations were computed for each half-hourly group. For the pole observations, the north and the east components of each half-hourly average velocity were determined. For the entire series the average north component, the average east component, and the resultant velocity and direction represented by the two were computed. This resultant is the average nontidal current for the series.

The half-hourly averages of velocity and direction were so plotted on polar coordinate paper that the distance and direction of each plotted point represented the velocity and direction, respectively, of the current at a designated half hour of the tide. The nontidal current for the series was similarly plotted. The plotted half-hourly velocities generally formed a rough ellipse with the plotted nontidal current in the approximate center serving as a new origin from which the velocity and direction of the tidal current for each half hour could be measured. These half-hourly values were scaled from the ellipse and, after applying to each velocity a factor to correct for range of tide at the reference station as explained on page 19, part I, both the velocities and the directions were plotted on cross-section paper. From these plottings the time, direction, and velocity of each maximum and minimum phase of the current were tabulated.

For the meter depths at the rotary stations, the nontidal current could not be computed as the directions of the observed velocities were not known. The velocities, however, were tabulated and averaged in half-hourly groups and the range factor applied directly to each average. The resulting mean half-hourly velocities were plotted on cross-section paper and the times and magnitudes of the maximum and minimum velocities tabulated as in the case of the pole observations.

IRREGULAR CURRENTS

Certain current stations in the vicinity of Edgartown Harbor show a departure from the usual reversing current in that two maximums of velocity separated by a period of smaller velocity occur during the normal flood or ebb period of about 6 hours. Tabulations and reductions for such stations have been made in the usual manner except that the strength of flood or ebb has been divided into three phases designated first strength, minimum flood or ebb, and second strength. The times, directions, and velocities of each of these phases were subjected to the processes usually employed in reducing normal flood or ebb strengths.

LIGHTSHIPS

The hourly pole observations at some of the lightships were treated in a manner similar to that described for the pole observations at the 1934 stations where the current was rotary in nature. In most such cases the observed velocities were first resolved into north and east component velocities, each component being tabulated separately and final results derived as outlined on page 19, part I, for the 1930–31 series at Brenton Reef Lightship. No correction was applied to the average velocities from any lightship series as the observational periods were in all cases long and, consequently, the more important velocity variations were eliminated by the averaging process.

HARMONIC ANALYSIS

Harmonic analyses of the hourly velocities observed at a number of the lightship stations have been made. Some of the series were analyzed on a reversing basis, the flood velocities being considered as positive and the ebb velocities negative. Others were treated as rotary currents, the velocities being resolved into their north and east components, and a separate analysis made for each component

To investigate the nature of the current irregularity observed in Edgartown Harbor, a special harmonic analysis was made of the half-hourly velocities observed at station H 19. The lunar constituents only were sought and the values as directly obtained were corrected by comparison with a simultaneous series of tides at Commonwealth Piers, Boston.

For a detailed explanation of the application of harmonic analysis to the reduction of tides and tidal currents, reference is made to United States Coast and Geodetic Survey Special Publication No. 98, A Manual of the Harmonic Analysis and Prediction of Tides.

PRESENTATION OF THE RESULTS

DESIGNATION AND LOCATION OF STATIONS

Each current station in the Nantucket-Vineyard Sounds area has been given a designation which consists generally of two parts: First a letter or letters signifying the party or the chief of the party that occupied the station, and second, a number or letter which is, wherever possible, the designation originally assigned to the station. The letters forming the first part of the designation and the party signified in each case are as follows:

B=G. S. Blake, 1844.	Mi=H. Mitchell, 1863.
D=C. H. Davis, 1846–47.	Mt=H. Mitchell, 1871.
W=M. Woodhull, 1850–51.	Ha=J. M. Hawley, 1886.
Wd=M. Woodhull, 1852–53.	Ma=H. L. Marindin, 1891.
Mc=C. H. McBlair, 1852.	L=Crew of Lightship, 1911–36.
M=H. Mitchell, 1857.	H=E. F. Hicks, 1934.

The locations of the stations are indicated in figures 46, 47, and 48 by red circles together with the corresponding station designations. The locations occupied during the period 1844 to 1853, inclusive, are shown in figure 46; those occupied from 1857 to 1886 in figure 47; and those occupied from 1891 to 1936 in figure 48.

EXPLANATION OF THE TABULAR DATA

As the tabular results derived from observations in Nantucket and Vineyard Sounds apply to two different types of current, they fall naturally into two groups. One group of results represents a reversing movement with a velocity varying from zero to a maximum and back to zero during a flood period and repeating the process in an approximately opposite direction during an ebb period. The other group represents a rotary movement, the velocity progressively shifting in direction and at the same time varying in magnitude from a minimum value to a maximum and back to a minimum during a flood period and repeating the process during an ebb period, successive maximums or minimums being in approximately opposite directions.

The currents at most of the stations are essentially of the reversing type and have been treated as such. However, at some of the lightship stations and the 1934 stations at which the rotary tendency was pronounced, the extent of this rotation is indicated in the results by substituting for the times of slack, as given for reversing currents, the times, directions, and velocities of the minimum currents.

Table 10 contains results from most of the current observations in Nantucket and Vineyard Sounds that were obtained on a reversing basis. Other results similarly obtained are given for some of the

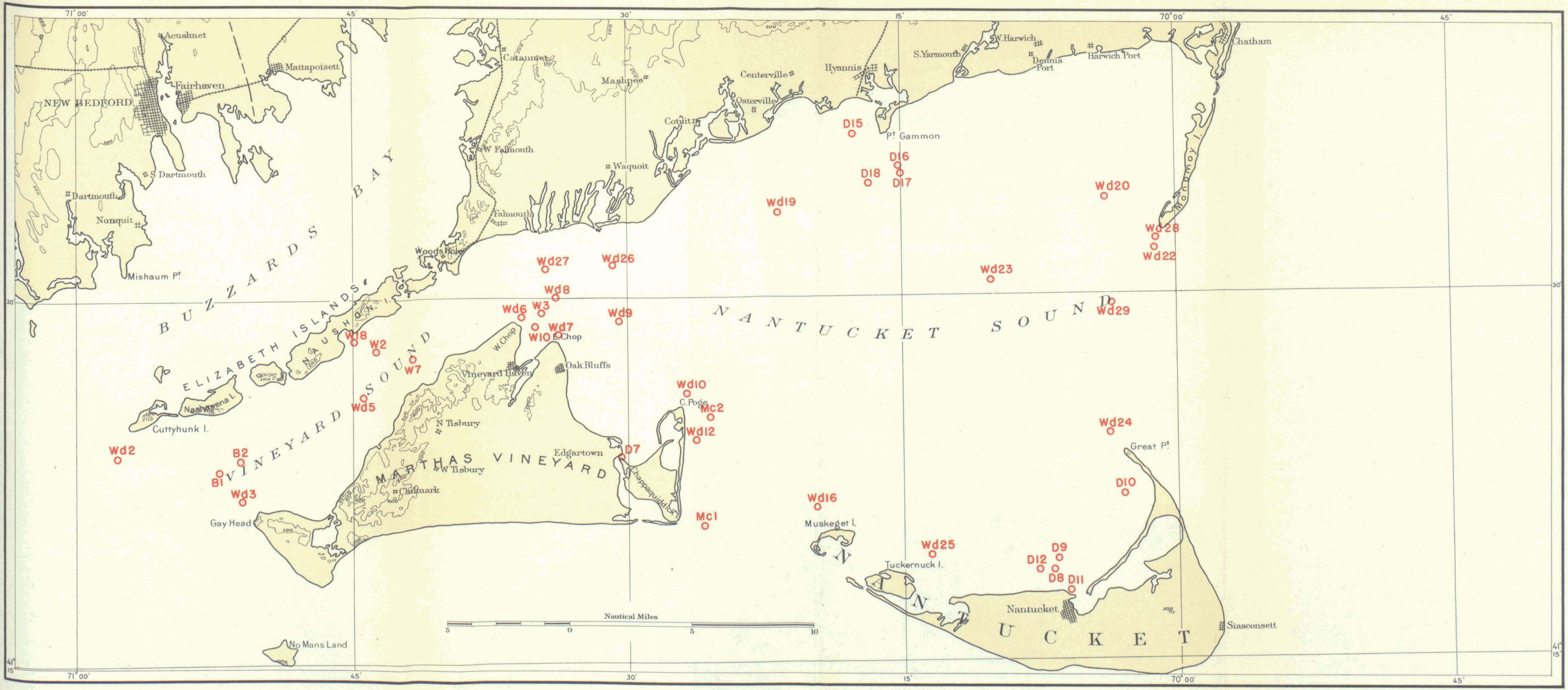

Fig. 46. Current stations, Nantucket and Vineyard Sounds, 1844-1853.

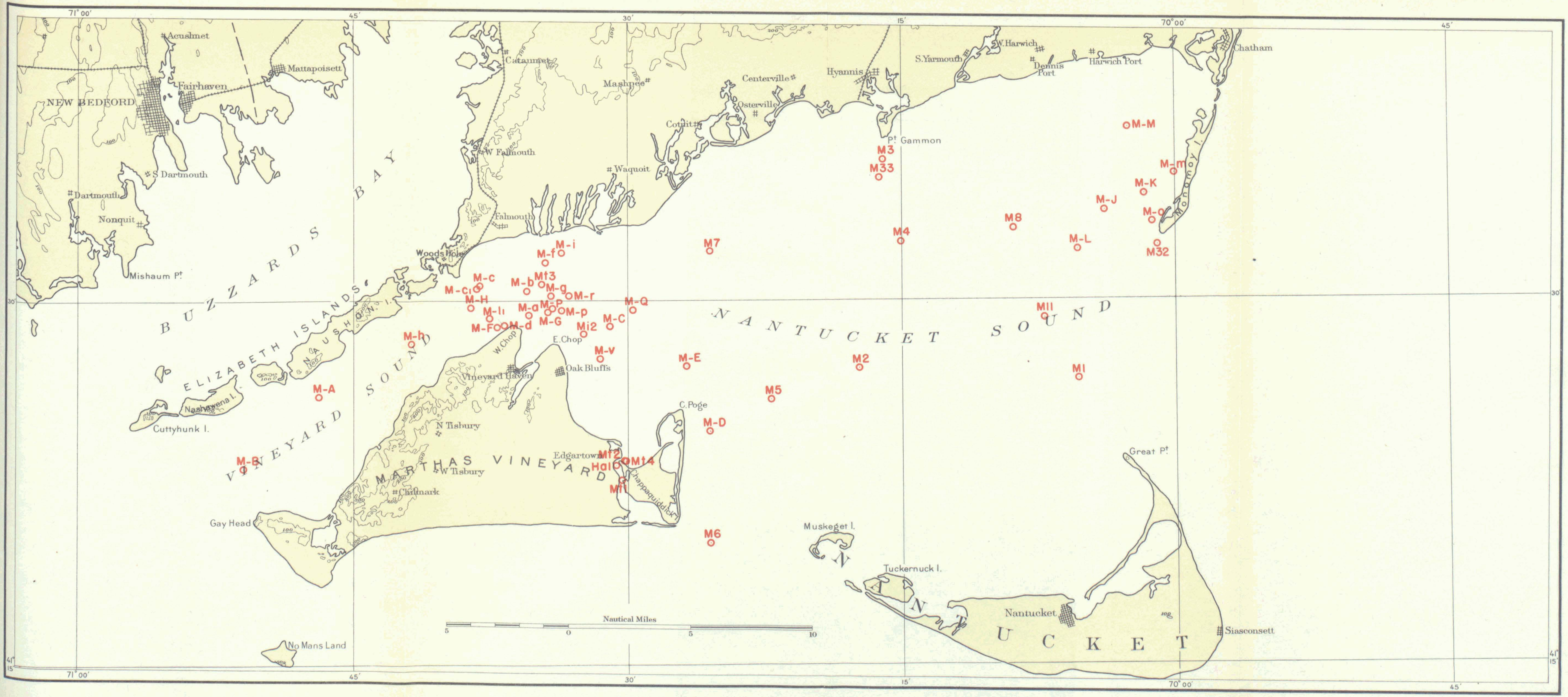

Fig. 47. Current stations, Nantucket and Vineyard Sounds, 1857-1886.

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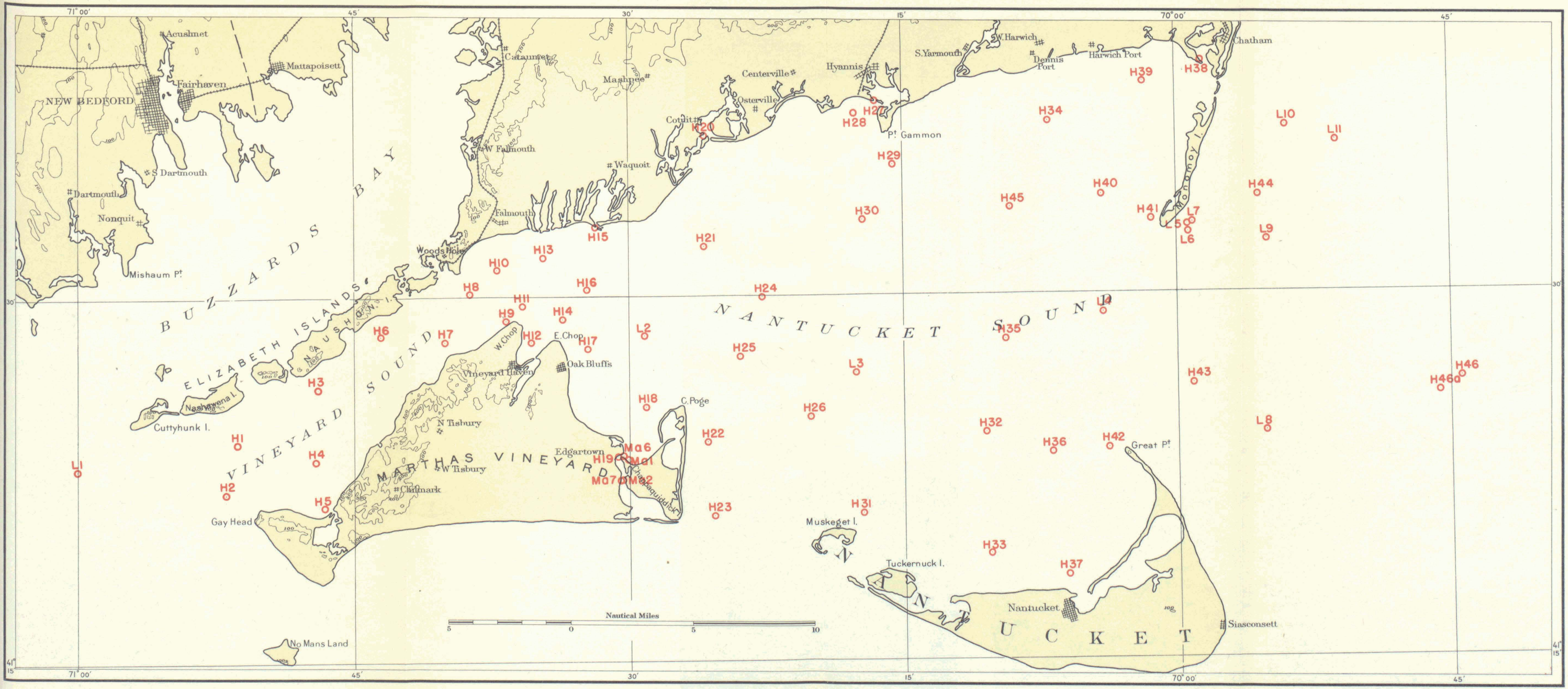

Fig. 48. Current stations, Nantucket and Vineyard Sounds, 1891-1936.

lightships and for stations in the vicinity of Edgartown in tables 12 and 14, respectively. The explanation given on page 51 for table 5, part II, of this volume applies to the three tables mentioned above, except that for a reference Boston instead of Clark Point tides are used and times are reckoned from both high and low waters instead of from high water only. Also, because of characteristic irregularities in the currents near Edgartown, additional current phases are given for some of the stations of table 14.

An examination of the results given in table 14 shows that the nature of the current movement in Edgartown Harbor and vicinity changes with changing hydrographic conditions at the southern extremity of Katama Bay.

In the year 1846 and again in 1891 the southern entrance to Katama Bay was open and the flood current from the ocean set through Katama Bay and Edgartown Harbor into Nantucket Sound. When the observations of 1871 and those of 1934 were taken, the southern entrance was closed or practically so and the flood current from Nantucket Sound set through Edgartown Harbor into Katama Bay.

The results further give evidence that the extent of the current irregularity observed in Edgartown Harbor varies with the opening and closing of this southern gateway to the ocean. When the southern entrance is closed the abnormality is pronounced, and when the southern entrance is open the current curve approximates the normal cosine form.

A discussion of currents observed in Edgartown Harbor and Katama Bay in 1891, including velocity curves for a number of locations and a sketch of the area showing three openings, from Katama Bay to the ocean, which existed at that time, is contained in Appendix No. 5, part II, of the report of the Superintendent of the Coast and Geodetic Survey for the year 1892.

Tables 11 and 13 contain for the rotary current stations results obtained as explained on page 72 under the heading "Rotary currents" in the section on methods of reduction. Table 11 consists of data derived from the 1934 observations and table 13 of data from observations at various lightships. In table 11 the values derived from the pole observations represent the tidal current corrected for range; that is, the average nontidal current for the series has been eliminated from the results. For the meter the values given are averages of observed values, the velocities having been corrected by direct application of the range factor.

The data given in table 13 were derived from relatively long series and they represent direct averages of observed conditions. The nontidal current is included in these values and no range factor has been applied. In both table 11 and table 13, the direction and velocity of the average nontidal current for each series of pole observations are given.

The harmonic constants derived as explained on page 73 from series of observations at various stations are given in tables 15, 16, and 17. These constants consist of the amplitudes (H's) and phase lags (κ's) of the more important periodic constituents of the current. Such constants form the basis for daily predictions of the current. From them also may be determined the general characteristics of the current movement and various nonharmonic constants which are usually obtained directly from observations.

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In tables 15 and 17, the constants represent a reversing condition, the movement in the flood direction being positive and that in the ebb direction negative. The phase lags or epochs in this case refer to the maximum flood of each constituent.

In table 16 the north and east components of the movement are represented separately, south and west being negatives of these. The epochs have reference to the maximum velocity of the constituents in a north or east direction. From the north and east component movements, the rotational features of the constituents may be developed.

Comparing the relative magnitudes of the several constituents given in tables 15 and 16, it is apparent that the lunar semidiurnal constituent M_2 is the predominant element of the current movement at the stations listed.

At station H 19 in Edgartown Harbor, the M_4 and M_6 constituents as given in table 17 are large relative to M_2. The fact that these short-period lunar constituents have abnormally large amplitudes at this location accounts for the marked departure of the current movement at station H 19 from the prevailing M_2 movement characteristic of Nantucket and Vineyard Sounds.

Daily predictions of the current at Stone Horse Shoal Lightship based upon the constants given in table 15 are included in the annual Atlantic Coast Current Tables beginning with the issue for the year 1937.

REVERSING CURRENT CURVES

In figures 49 and 50 are reproduced a number of velocity curves plotted directly from observations taken at various stations in 1934. The flood velocities are plotted above and the ebb velocities below the line representing zero velocity. Each group of two or three curves, plotted from a common datum line, represents simultaneous observations at the stations indicated. The date of the observations is given for each group.

The individual curves give an accurate picture of the movement as observed at each station, and a comparison of the curves in a given group shows the actual time and velocity differences observed at the several stations on the day indicated. As is usual with velocity curves plotted directly from observations, these curves show many irregularities. Some of the roughness is doubtless due to accidental conditions, such as weather effects and observational discrepancies, both of which are usually present to a greater or less degree. However, the more pronounced humps or depressions which appear on the curves frequently occur again and again in the same part of the current cycle, forming a characteristic peculiarity of the movement at a given location. The curves for stations H 15 and H 23, figure 50, show such persistent irregularities, and in the curve for station H 19 they are very marked. Other local peculiarities of the currents are evident from an examination of the curves. For example, at station H 27 the change from ebb strength to flood strength is very much more rapid than the change from flood strength to ebb strength.

ROTARY CURRENT DIAGRAMS

To show graphically the nature of the rotary current movements and the extent of the rotation at various lightship stations, diagrams have been prepared showing the velocity and direction of the current for each hour of the tidal cycle from 3 hours before to 3 hours after high water and low water at Commonwealth Piers, Boston. These diagrams are reproduced in figures 51 and 52. The explanation of the diagram for Hen and Chickens Lightship given on page 52, part II, together with the following brief statements will render these

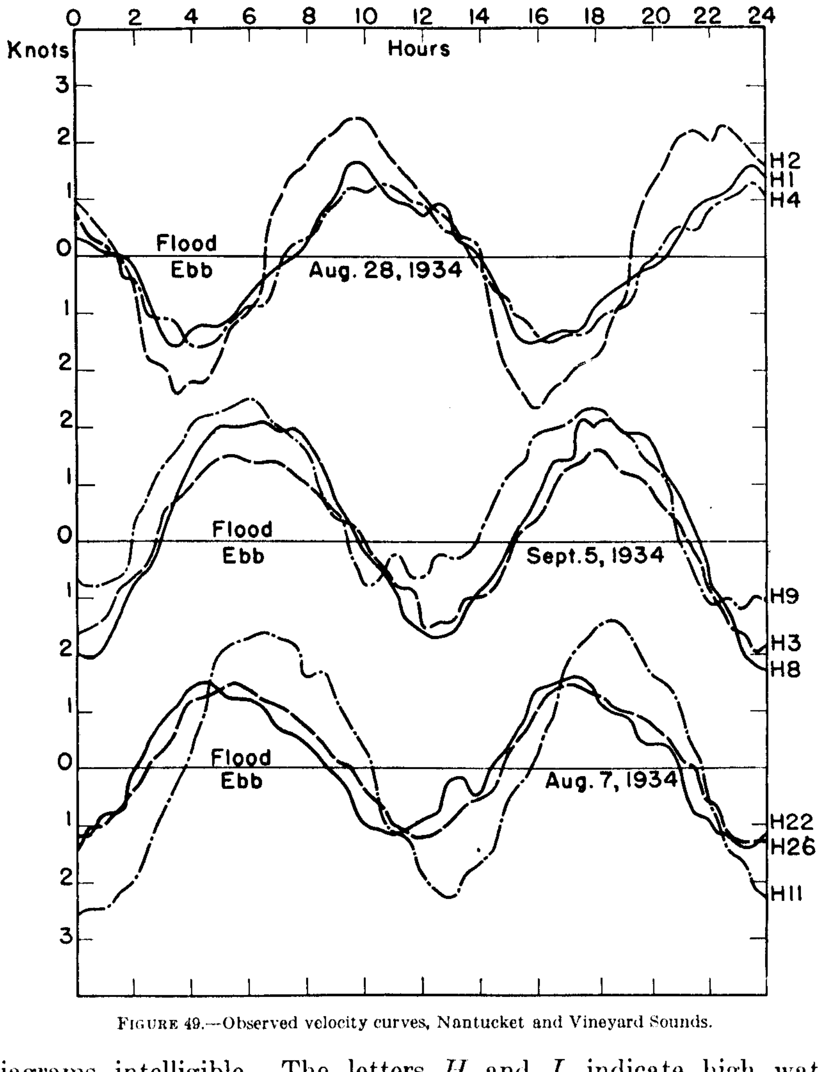

FIGURE 49.—Observed velocity curves, Nantucket and Vineyard Sounds.

diagrams intelligible. The letters *H* and *L* indicate high water and low water, respectively, at Boston. *H*−1 signifies 1 hour before high water, and *H*+1 signifies 1 hour after high water and so on. The point *C* by its distance and direction from the origin represents the velocity and direction of the average nontidal current for the series.

The stations at which the observations represented by the diagrams were taken are listed below by number and name, together with the length and year of each series used in preparing a diagram

Station no.	Name of lightship	Length	Year
		Days	
L 2	Hedge Fence	29	1913
L 3	Cross Rip	25	1934
L 4	Handkerchief	26	1934
L 7	Stone Horse Shoal (new position)	26	1934
L 8	Great Round Shoal	87	1911
L 9	Pollock Rip (old position)	87	1911
L 10	Pollock Rip Slue	180	1920
L 11	Pollock Rip (new position)	26	1934

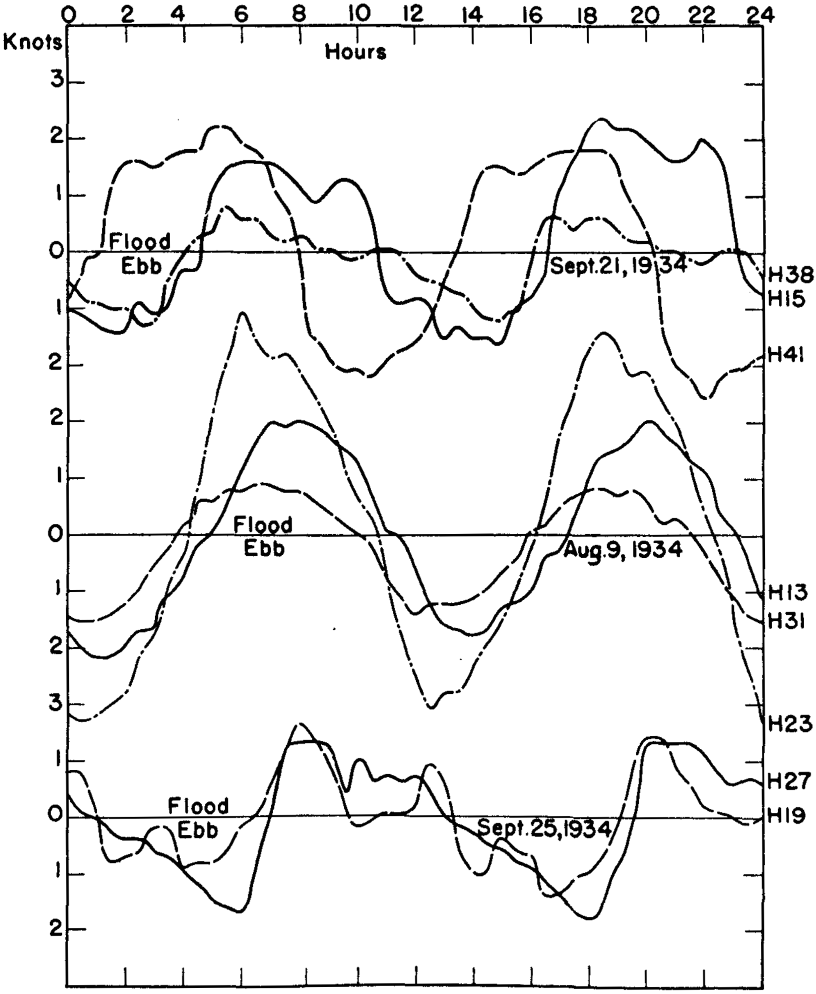

FIGURE 50.—Observed velocity curves, Nantucket Sound.

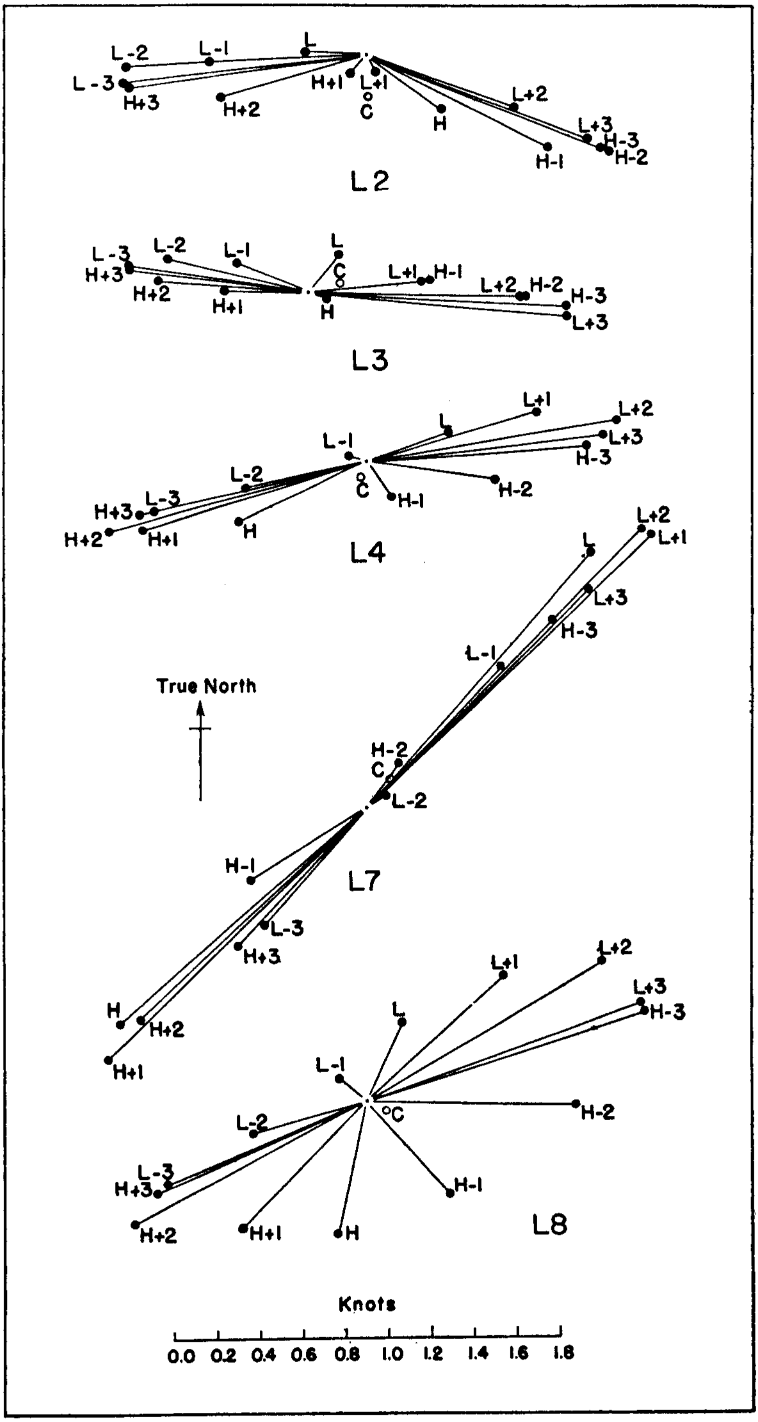

FIGURE 51.—Rotary current diagrams from observations at lightships; Nantucket Sound and eastern approaches.

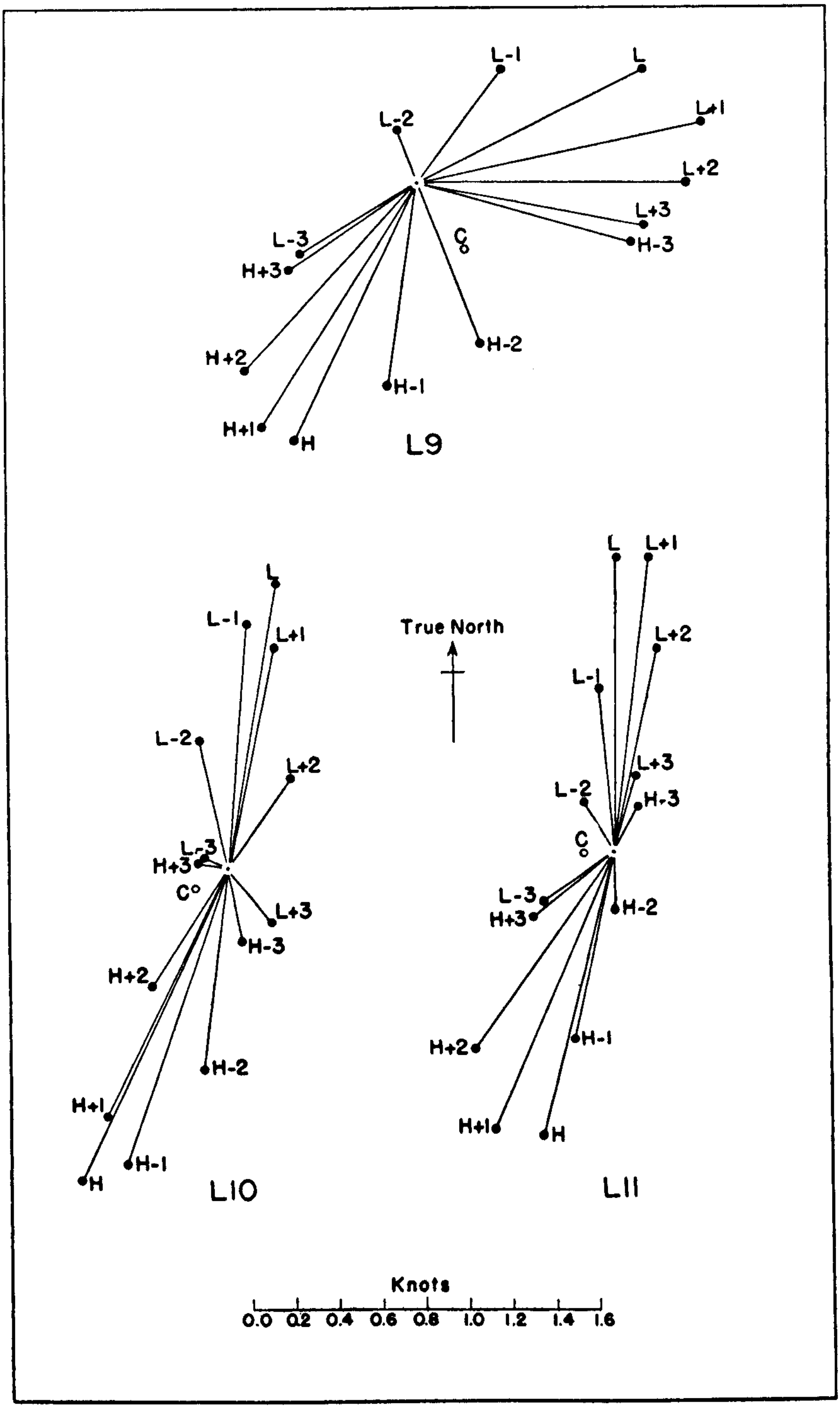

FIGURE 52.—Rotary current diagrams from observations at lightships; northern approaches to Nantucket Sound.

It is evident from the diagrams that the rotary tendency is very small at station L 7, whereas at stations L 8 and L 9 it is considerable. At the other stations it is present in varying degrees but is not sufficiently pronounced to modify greatly the general reversing condition.

The current ellipse for the M_2 constituent at Vineyard Sound Lightship, based upon the results of harmonic analyses of 2 months

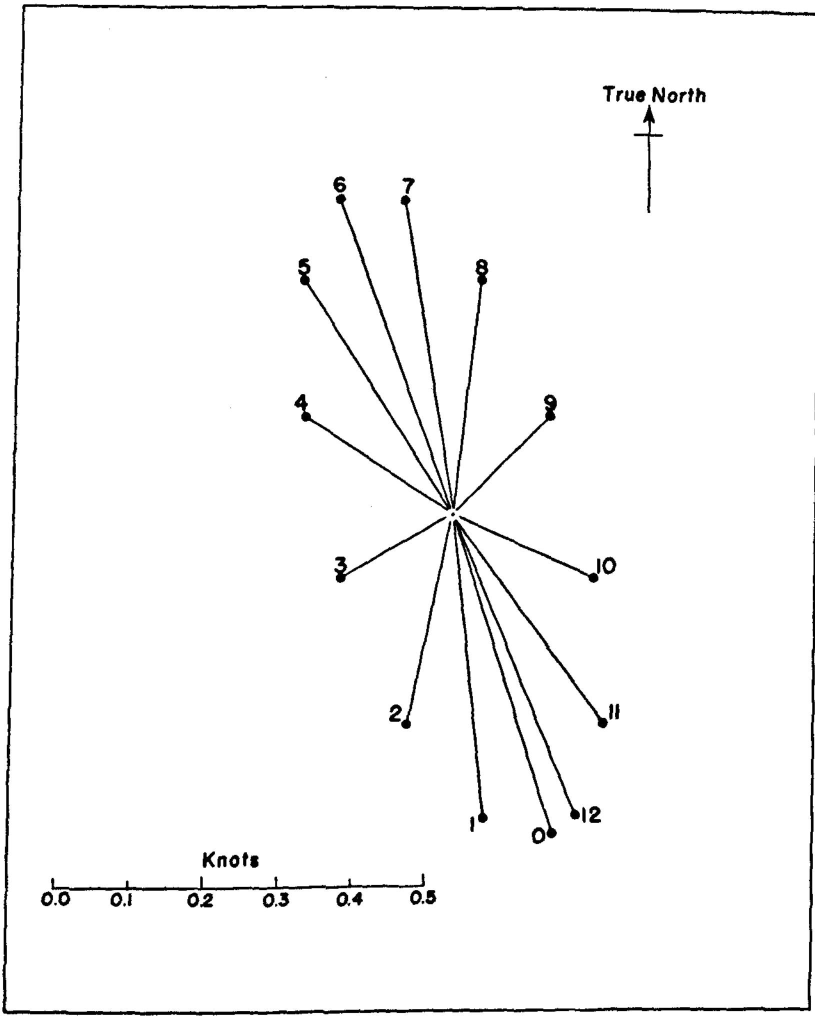

FIGURE 53.—M_2 current ellipse, Vineyard Sound Lightship.

of observations in 1913, is shown in figure 53. It indicates that this constituent, the predominating element of the tidal current at Vineyard Sound Lightship, reaches its strength of approximately one-half knot in a south-southeastward direction about the time of high water at Boston, and the following minimum velocity of nearly 0.2 knot in a west-southwestward direction about 3 hours after high water at Boston. Approximately 6 hours after each maximum there is a maximum of the same velocity setting in the opposite direction, and a like time and velocity relation exists between the two minimum phases.

TIME RELATION OF CURRENT TO TIDE

Where time relations of current to tide have been given for Nantucket and Vineyard Sounds in the tabular and graphical results discussed in the preceding pages, the reference used has been the tide at Commonwealth Piers, Boston. To show the times of the slacks and strengths near the main channel through the waterway in their relation to the times of local high and low waters, figure 54 has been prepared. The observed times of the four current phases at a number of stations in or near the channel from the western end of Vineyard Sound to Monomoy Point were plotted and curves drawn through the plotted points. On the same sheet, curves representing the approximate times of high water and low water as determined from observations along the shores were drawn. The same time reference, namely, the transit of the moon over the meridian of Greenwich has been used for both tides and currents. The scale at the top of the figure represents longitude and below this scale are given the names of a number of points along the channel.

The curves show that the time of the current in the channel is about an hour later at Hedge Fence than off Gay Head. Eastward of Hedge Fence it becomes earlier, being about 2½ hours earlier at Stone Horse Shoal than at Hedge Fence. Variations from place to place in the time relations between current and tide are considerably larger than the above values. For example, the two lower curves of figure 54 show that the slack water before ebb in the channel north of Gay Head occurs nearly 4 hours after local high water. At Hedge Fence, this current phase occurs at about the same time as local high water, and at Stone Horse Shoal it comes about 2½ hours before local high water.

It is seen that the time relation of current to local tide varies widely from place to place and that the time of current in the main channel through the sounds remains practically constant over the part of the waterway in the vicinity of West Chop where the time of tide changes most rapidly. It appears, therefore, that the time of this current is practically unaffected by local conditions of rise and fall, and is controlled by the more extensive movement in the Gulf of Maine.

CURRENT CHARTS

The observed direction and velocity of the current at a number of locations in Nantucket and Vineyard Sounds and vicinity for each hour from 2 hours before to 3 hours after high and low waters at Commonwealth Piers, Boston, is represented in figures 55 to 66. The observations used in preparing the charts were taken by Hicks in 1934 and by the crews of lightships at various times. They were all taken within 14 feet of the surface. The locations at which the observations were taken are marked by small circles. The observed directions of flow for the designated hour of the tide are represented by arrows drawn through the circles. The mean velocities for the designated hour are shown to the nearest tenth of a knot by numerals near the circles. At times of spring tides and perigean

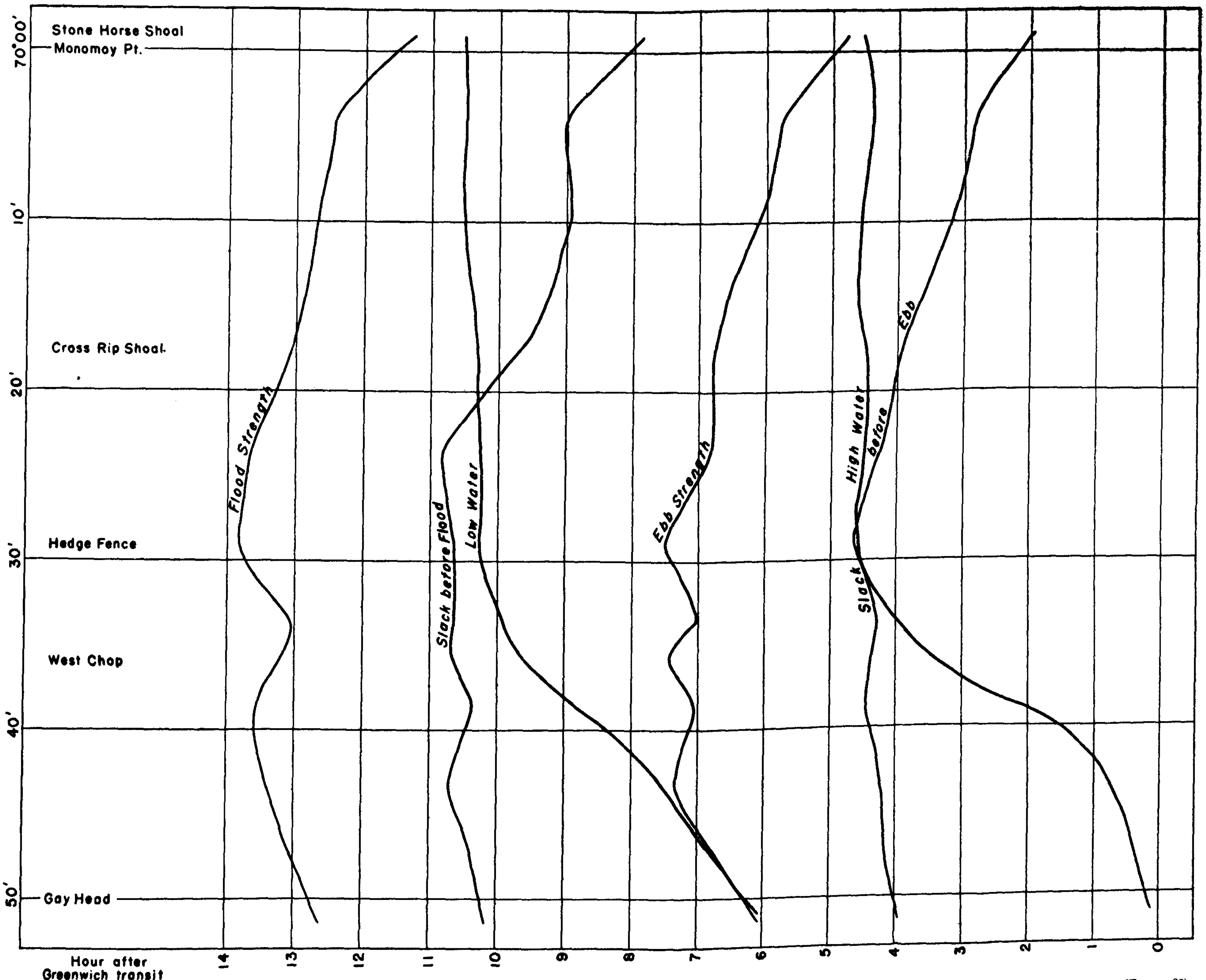

FIGURE 54.—Tide and current intervals, Nantucket and Vineyard Sounds.

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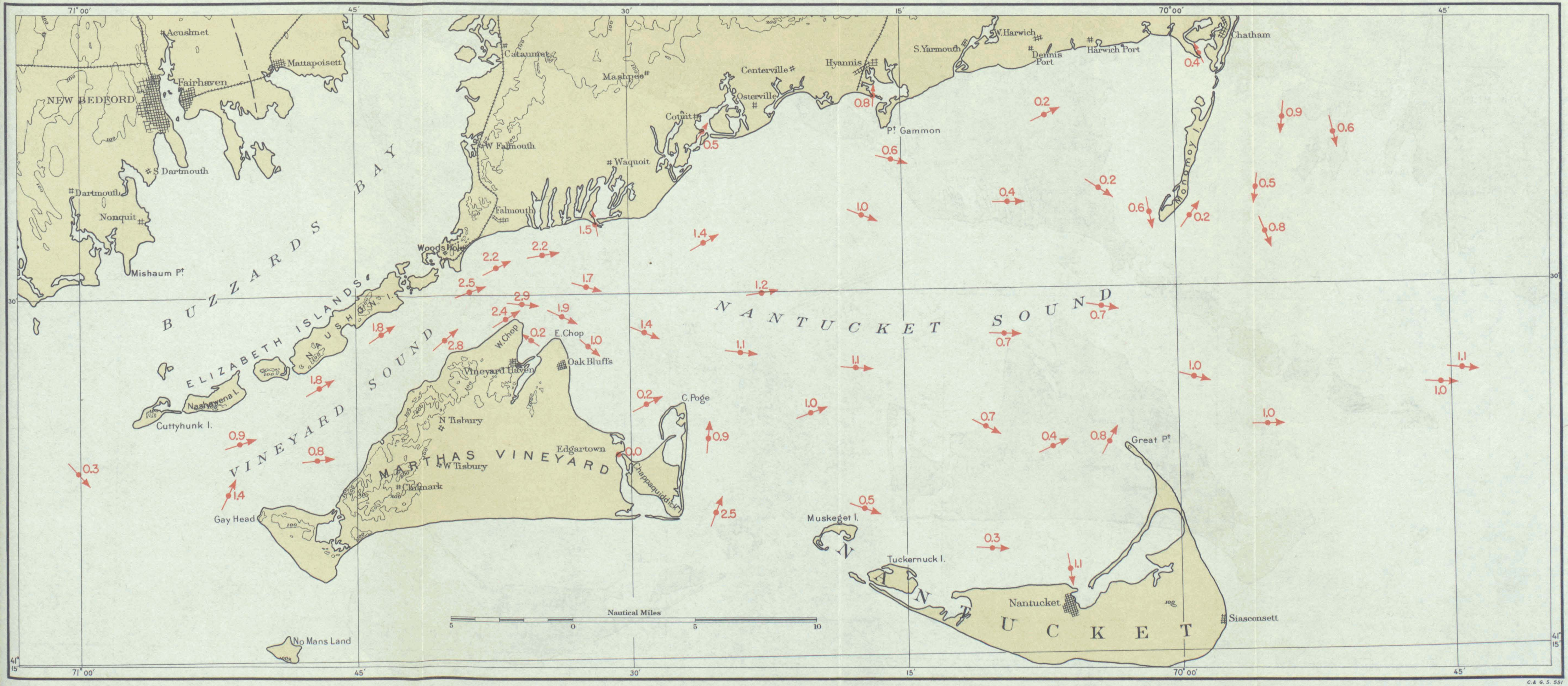

Fig. 55. Currents two hours before high water at Boston (Commonwealth Piers).

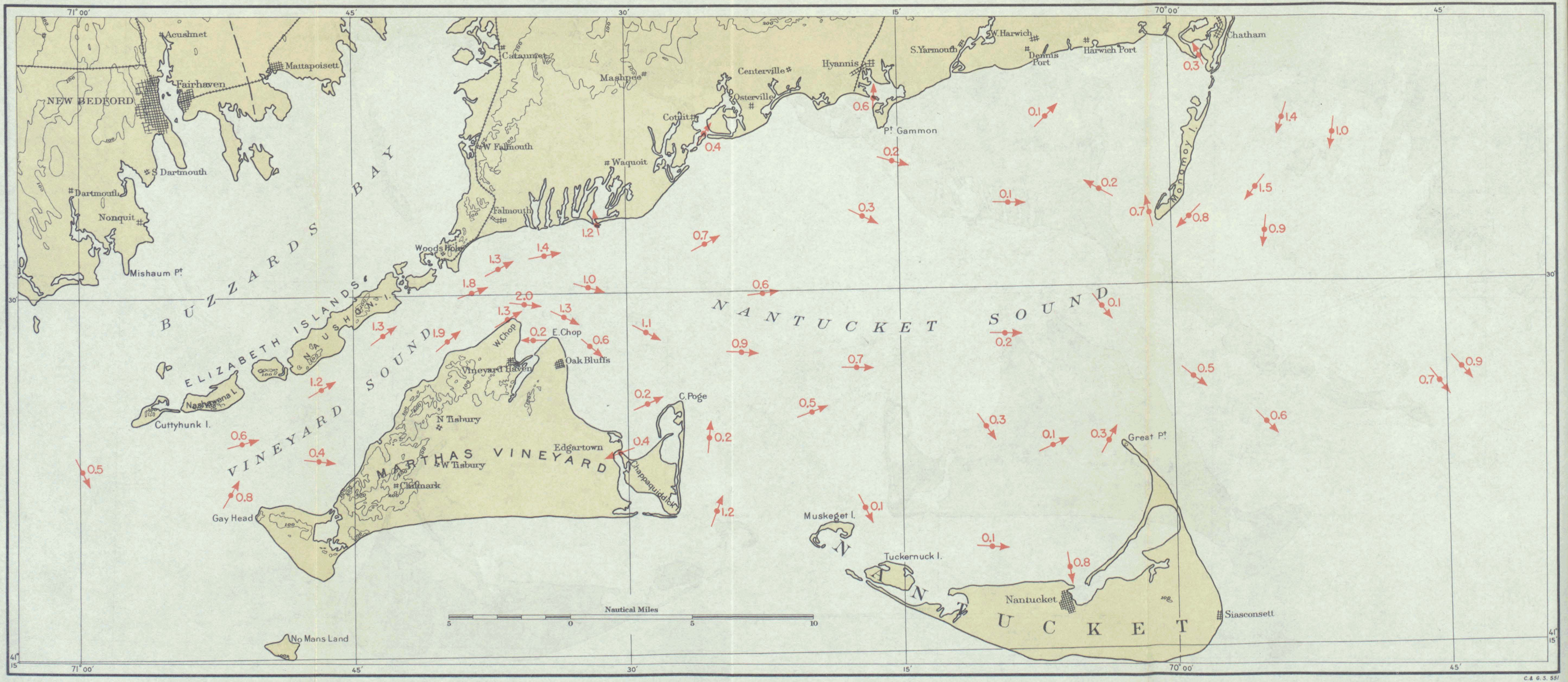

Fig. 56. Currents one hour before high water at Boston (Commonwealth Piers).

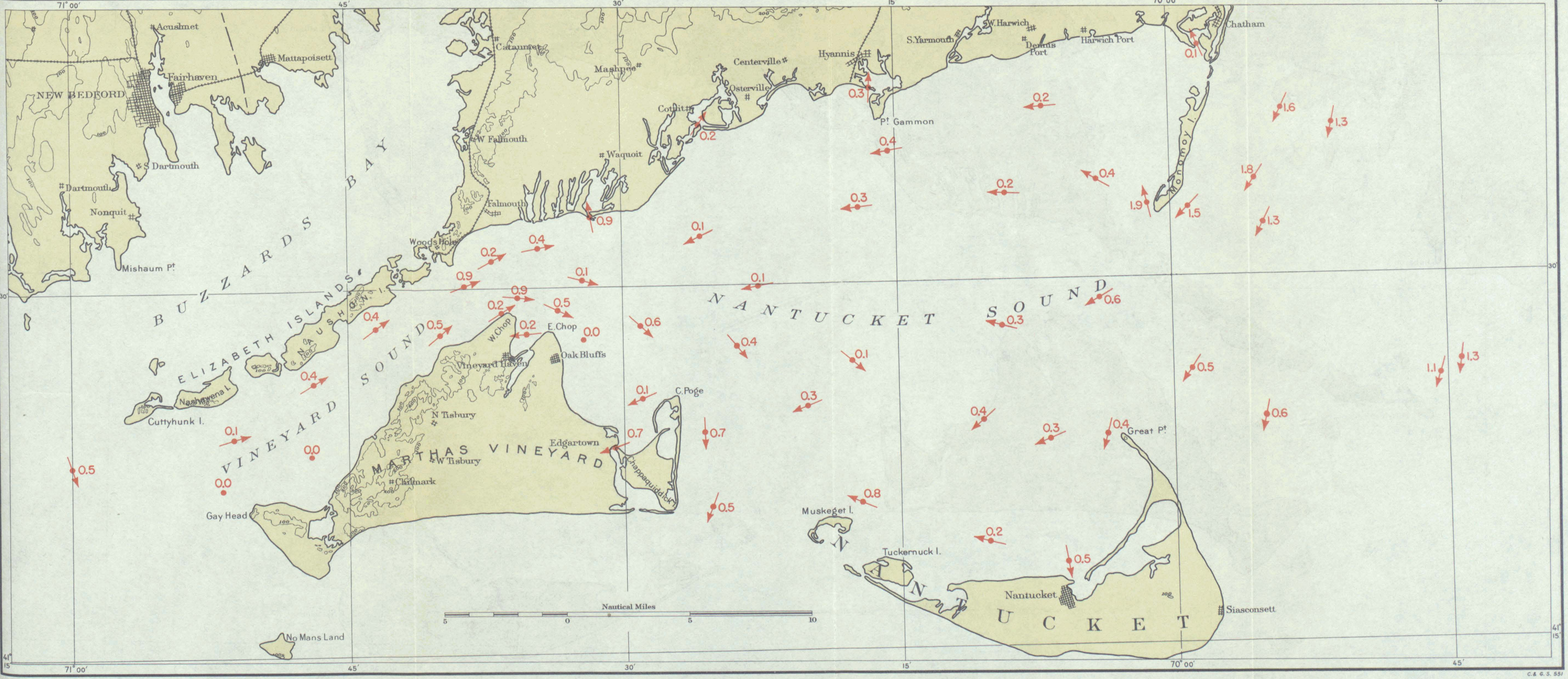

Fig. 57. Currents at time of high water at Boston (Commonwealth Piers).

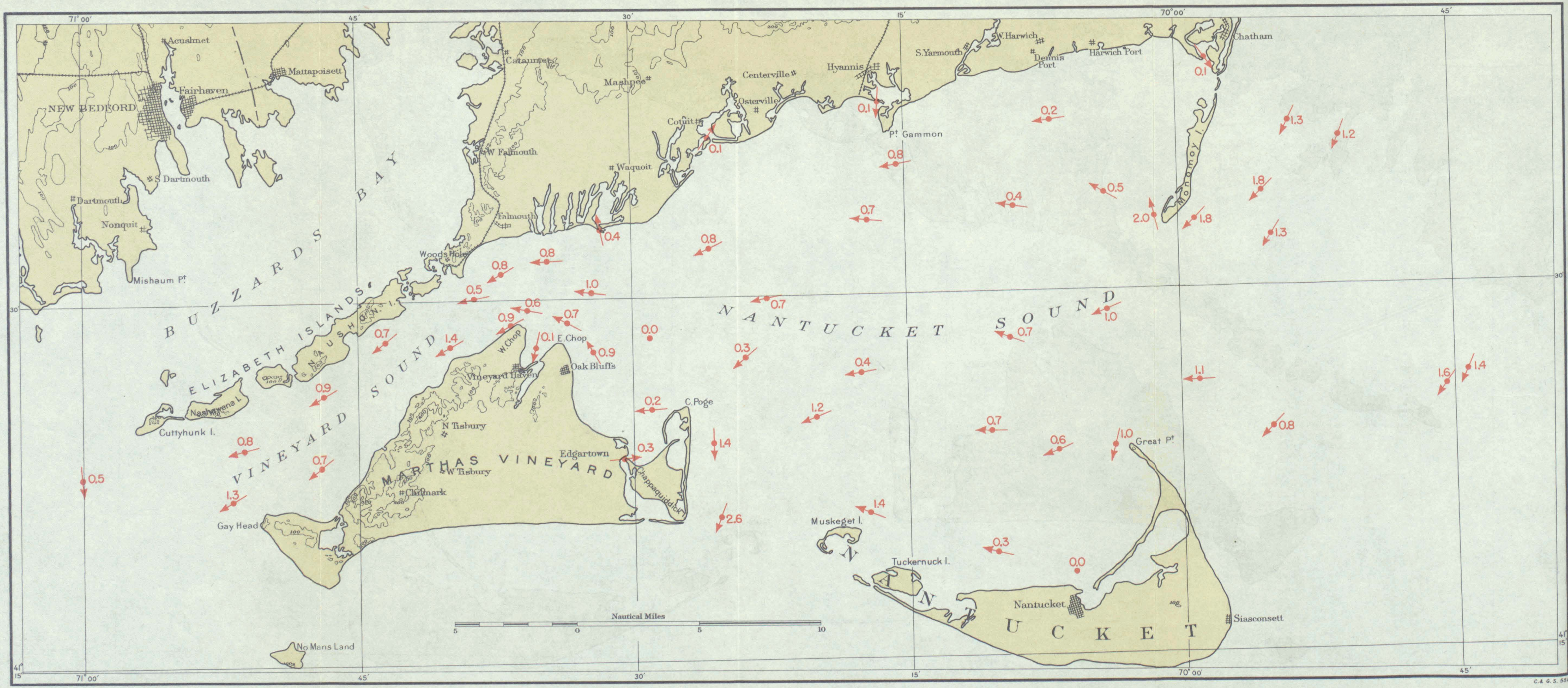

Fig. 58. Currents one hour after high water at Boston (Commonwealth Piers).

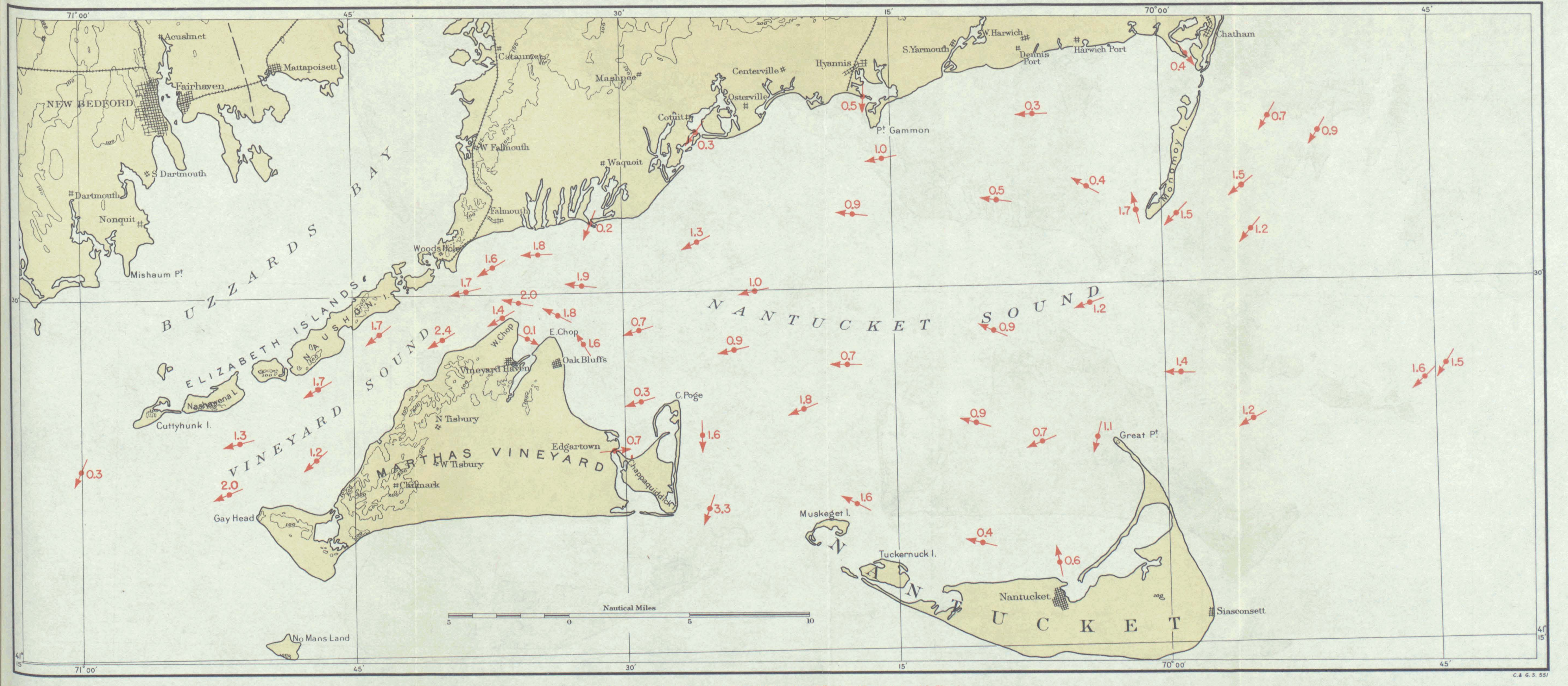

Fig. 59. Currents two hours after high water at Boston (Commonwealth Piers).

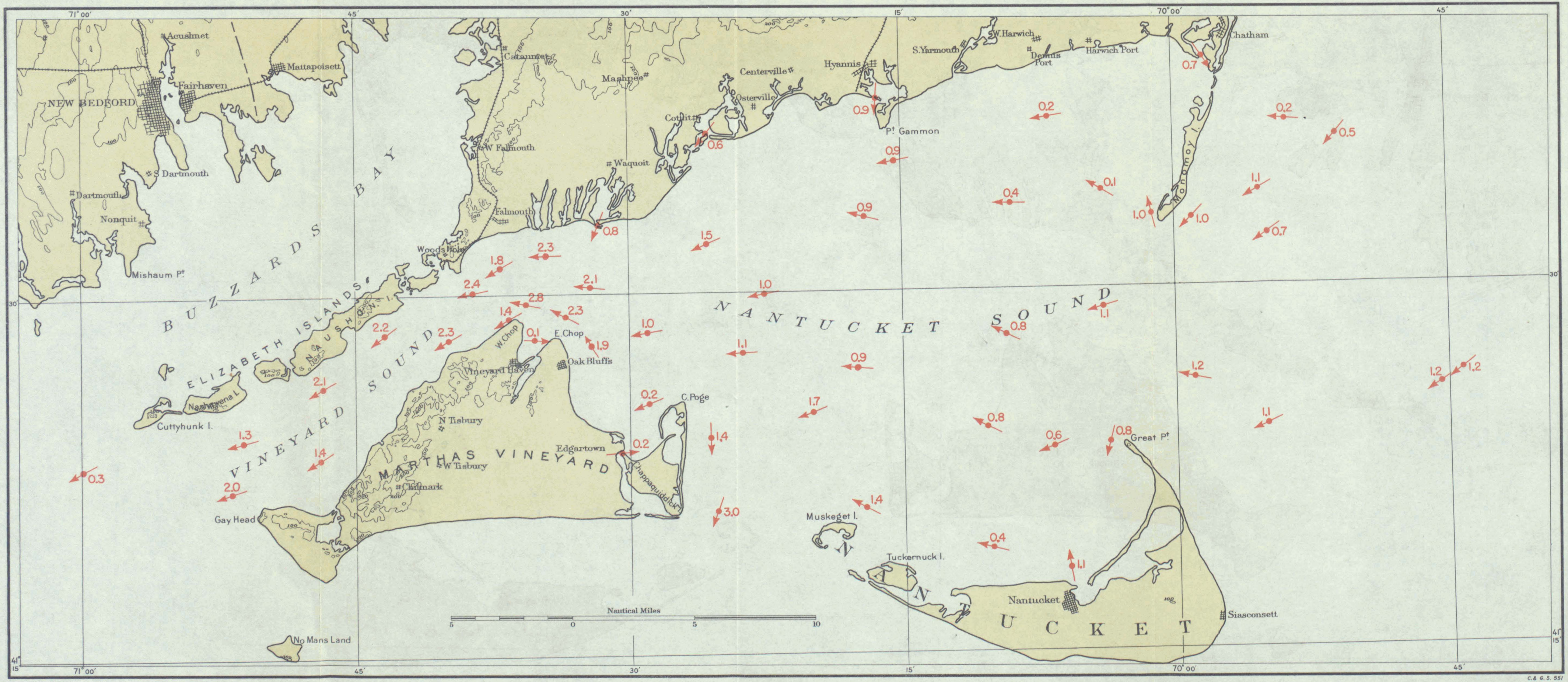

Fig. 60. Currents three hours after high water at Boston (Commonwealth Piers).

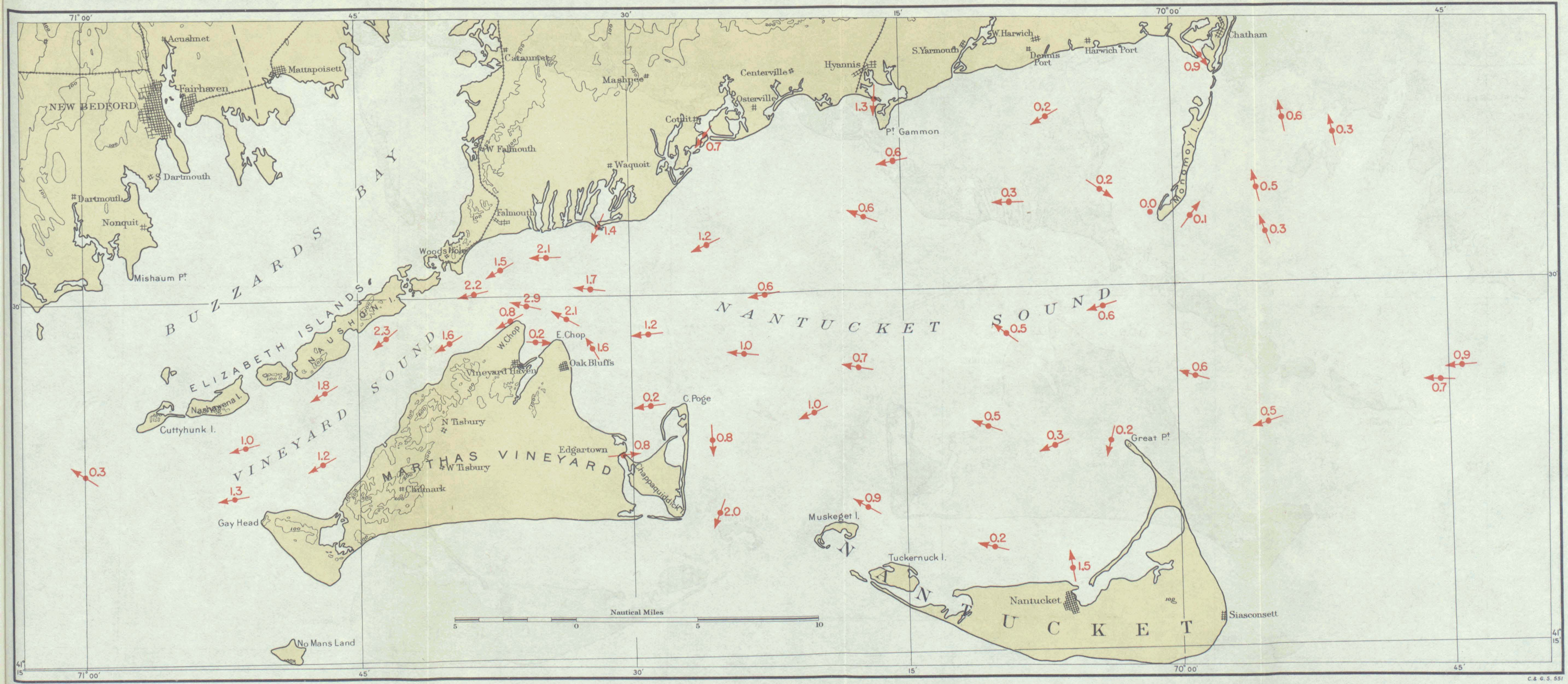

Fig. 61. Currents two hours before low water at Boston (Commonwealth Piers).

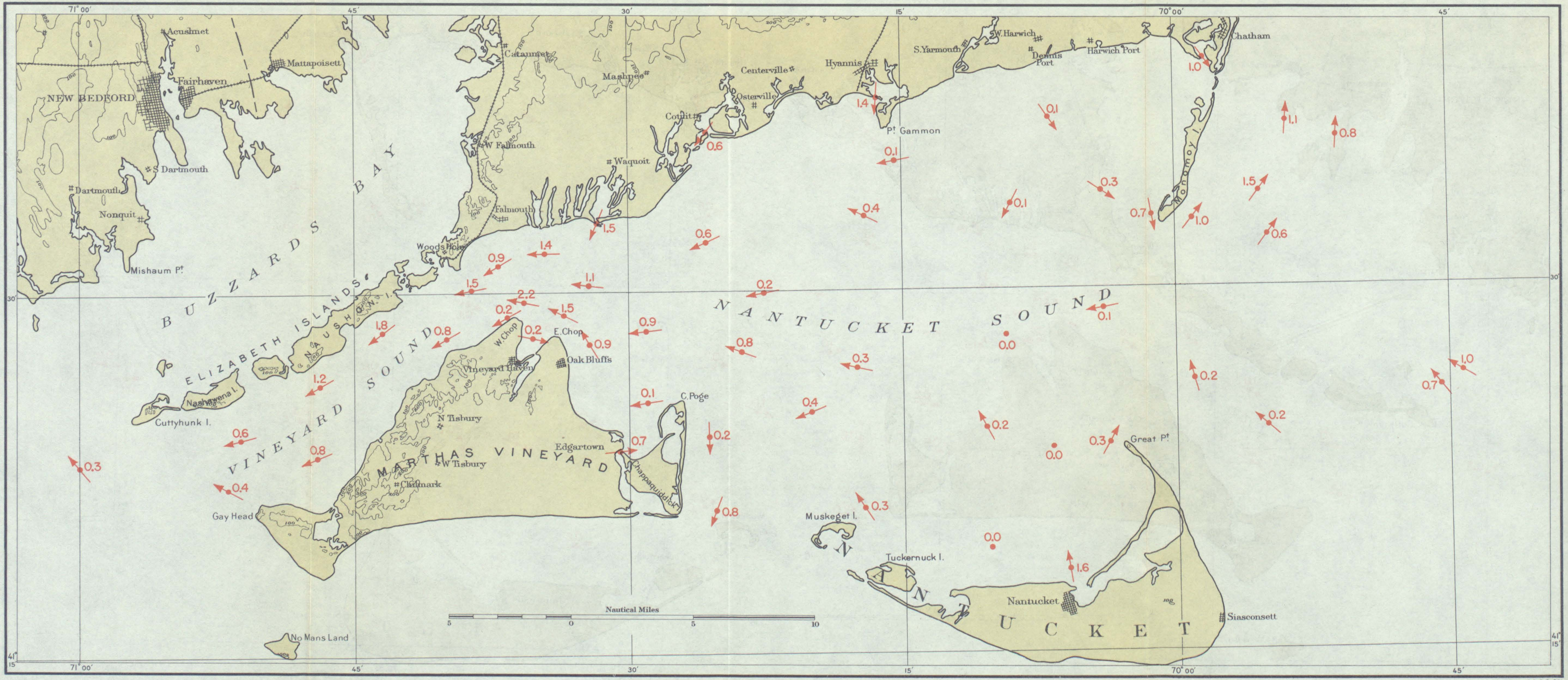

Fig. 62. Currents one hour before low water at Boston (Commonwealth Piers).

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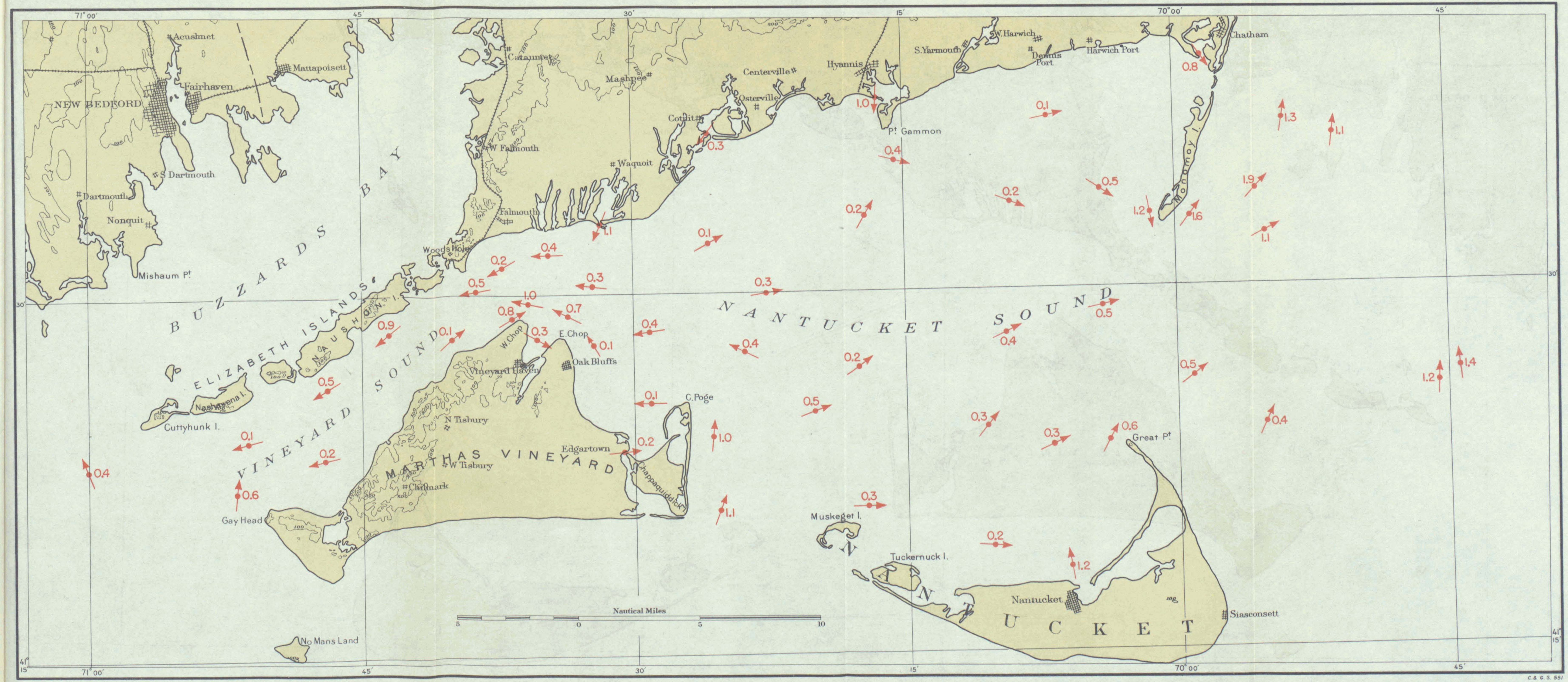

Fig. 63. Currents at time of low water at Boston (Commonwealth Piers).

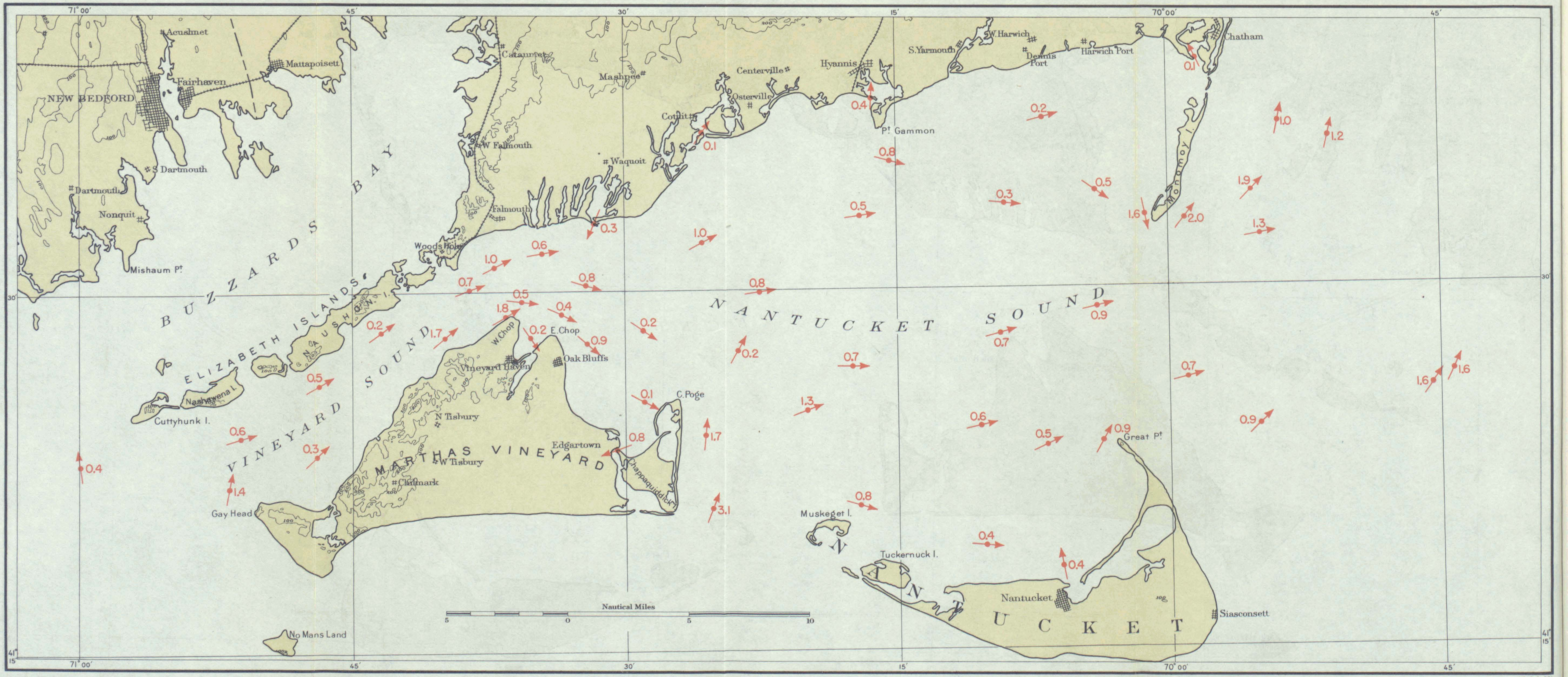

Fig. 64. Currents one hour after low water at Boston (Commonwealth Piers).

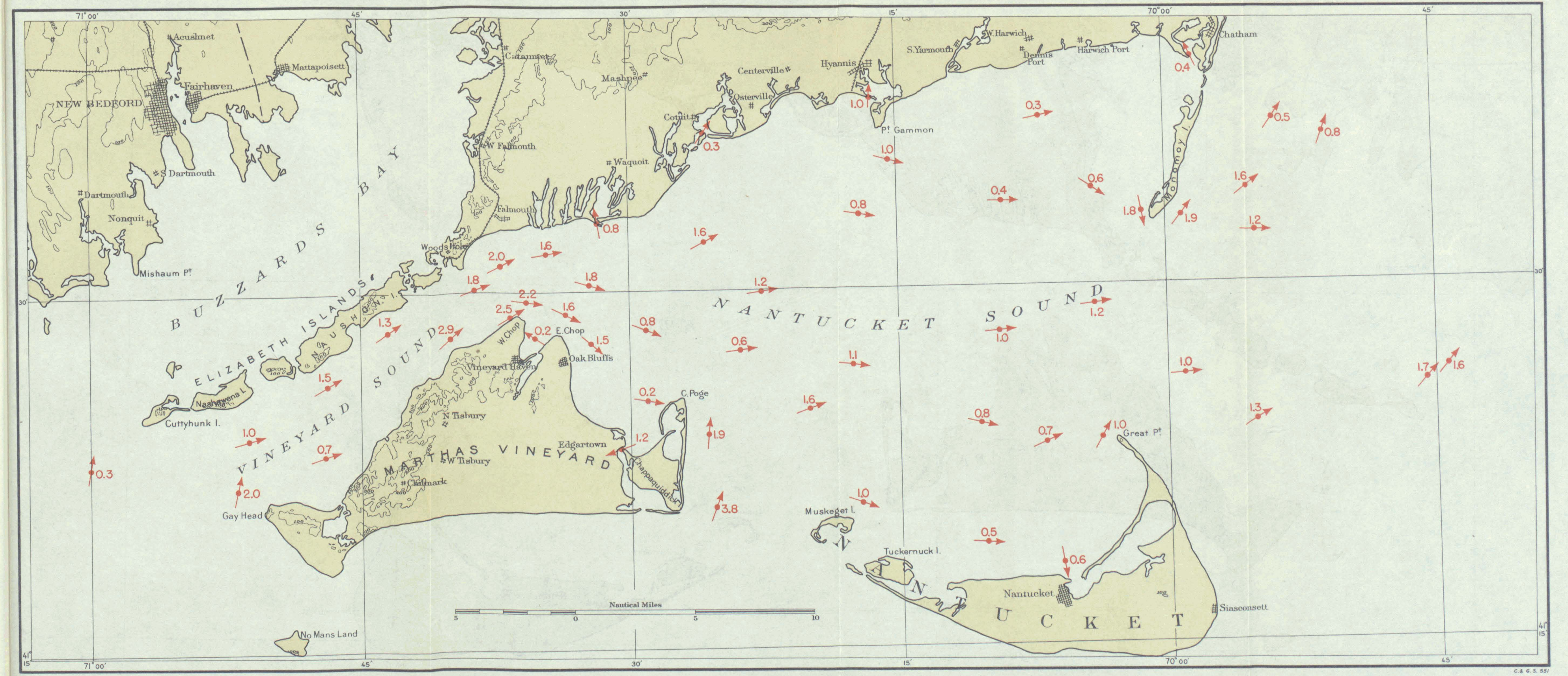

Fig. 65. Currents two hours after low water at Boston (Commonwealth Piers).

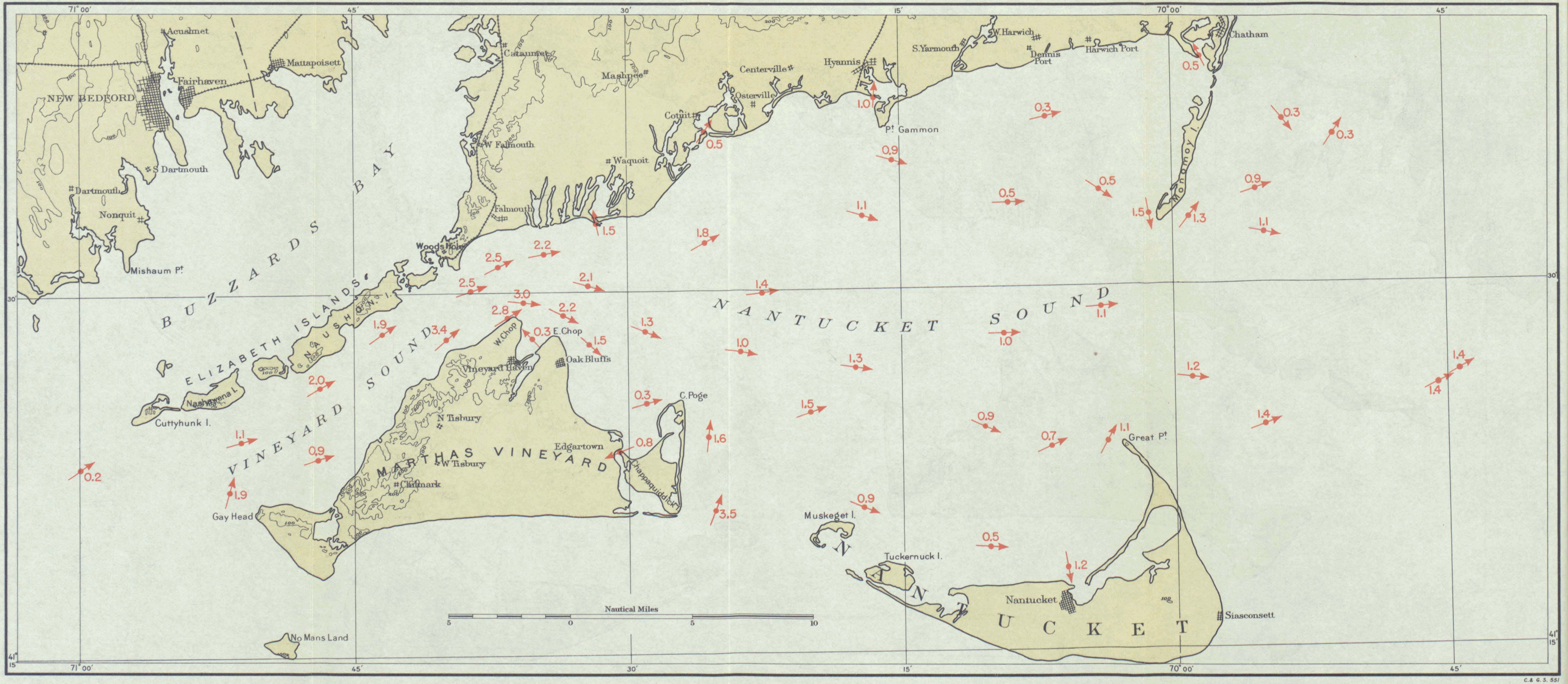

Fig. 66. Currents three hours after low water at Boston (Commonwealth Piers).

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tides, the velocities normally are greater and at times of neap tides and apogean tides less than those given on the charts. The spring and perigean effects are practically equal in this locality, each producing a velocity increase above the mean of about 20 percent. When spring and perigean effects combine, the velocities of the tidal current are greatest. When neap and apogean effects combine, the velocities of the tidal current are least. Winds and other meteorological conditions at times modify both the direction and the velocity of the current.

TABLE 10.—*Current Data, Nantucket and Vineyard Sounds, Strengths and Slacks*

[Referred to times of high water and low water at Commonwealth Piers, Boston]

Station no.	Observer, location, and year	Observations				Slack	Flood strength			Flood duration	Slack	Ebb strength			Ebb duration	Mean current hour
		Date	Period	Method	Depth		Time	True direction	Velocity			Time	True direction	Velocity		
	G. S. BLAKE, 1844		*Days*		*Feet*	*Hours after low water*	*Hours after low water*	*Degrees*	*Knots*	*Hours*	*Hours after high water*	*Hours after high water*	*Degrees*	*Knots*	*Hours*	*Hours*
B 1	2.5 miles N., 40° W. of Gay Head Light (41°22'.9' N; 70°52.3' W.).	July 18, 1844	½	Log	0	−0.11	2.69	29	1.64	7.42	1.06	3.76	275	1.04	5.00	0.93
				do	21	−0.11	2.69	37	1.64	7.22	0.86	3.56	264	1.14	5.20	0.83
B 2	2.7 miles N. 16° W. of Gay Head Light (41°23.5' N.; 70°51.2' W.).	July 15–16, 1844	½	do	0	0.49	3.09	38	1.95	6.02	0.26	4.16	267	1.35	6.40	1.08
				do	21	0.49	3.09	41	1.95	6.02	0.26	4.16	267	1.35	6.40	1.08
	C. H. DAVIS, 1846-47															
D 8	1.6 miles N. 42° W. of Brant Point Light (41°18.6' N.; 70°06.8' W.).	Aug. 23, 1846	½	Float	0	(1)	------	------	------	------	------	------	------	------	------	------
D 9	1.9 miles N. 28° W. of Brant Point Light (41°19.1' N.; 70°06.6' W.).	Aug. 31, 1846	1	do	0	(2)	------	------	------	------	------	------	------	------	------	------
D 10	1.7 miles S. 4° W. of Great Point Light (41°21.7' N.; 70°03.0' W.).	Aug. 31–Sept. 1, 1846.	½	do	0	(3)	------	------	------	------	------	------	------	------	------	------
D 11	0.6 mile N. 47° W. of Brant Point Light (41°17.8' N.; 70°06.0' W.).	Aug. 23, 1846	¾	do	0	1.24	4.44	150	0.50	6.32	1.31	5.01	314	0.60	6.10	2.08
D 12	2.0 miles N. 53° W. of Brant Point Light (41°18.6' N.; 70°07.6' W.).	Aug. 22, 1846	½	do	0	(4)	------	------	------	------	------	------	------	------	------	------
D 15	1.2 miles S. 89° W. of old tower, Point Gammon (41°36.6' N.; 70°17.6' W.).	Sept. 18, 1847	½	do	0	−1.10	2.00	79	0.32	6.11	−1.24	1.56	290	0.37	6.31	11.81
D 16	1.4 miles S. 25° E. of old tower, Point Gammon (41°35.3' N.; 70°15.2' W.).	Sept. 14, 1847	½	do	0	−1.60	3.00	81	1.05	7.11	−0.74	1.56	275	0.85	5.31	12.06
D 17	1.7 miles S. 26° E. of old tower, Point Gammon (41°35.0' N.; 70°15.0' W.).	Sept. 16, 1847	½	do	0	−0.95	2.50	71	1.07	6.46	−0.74	2.26	274	0.97	5.96	12.27
D 18	2.1 miles S. 17° W. of old tower, Point Gammon (41°34.6' N.; 70°16.8' W.).	Sept. 17, 1847	½	do	0	−0.90	1.50	94	0.64	6.36	−0.79	2.26	256	0.84	6.06	12.02
	M. WOODHULL, 1850-53															
W 2	1.3 miles S. 79° E. of Tarpaulin Cove Light (41°27.9' N.; 70°43.8' W.).	July 27–28, 1851	1	do	0	0.80	3.85	60	1.26	5.96	0.51	3.46	225	1.86	6.46	1.24
				Pole	7½	0.75	3.65	------	1.45	6.01	0.51	3.41	------	1.95	6.41	1.16
W 3	1.1 miles N. 61° E. of West Chop Light (41°29.4' N.; 70°34.7' W.).	Aug. 24–25, 1851	1	Float	0	0.70	3.50	111	1.90	6.06	0.51	3.76	290	2.10	6.36	1.20
				Pole	7½	0.70	3.50	------	2.13	6.21	0.66	3.76	------	2.23	6.21	1.24
W 7	2.8 miles S. 78° E. of Tarpaulin Cove Light (41°27.6' N.; 70°41.8' W.).	Aug. 18–19, 1851	1	Float	0	0.60	2.75	28	1.86	6.46	0.81	3.46	203	1.61	5.96	0.99
				Pole	5	0.55	2.80	------	1.93	6.51	0.81	3.46	------	1.78	5.91	0.99
W 10	0.8 mile E. of West Chop Light (41°28.8' N.; 70°35.1' W.).	Aug. 12–13, 1851	1	Float	0	−0.20	2.05	121	1.15	6.01	−0.44	1.96	306	1.75	6.41	12.34
				Pole	7½	−0.20	2.05	------	1.25	6.01	−0.44	2.06	------	1.95	6.41	12.37
W 18	0.4 mile N. 69° E. of Tarpaulin Cove Light (41°28.3' N.; 70°45.0' W.).	Oct. 4–5, 1850; July 14–15, 1851; Aug. 3–4, 1851.	3	Float	0	0.35	2.30	34	1.08	5.55	−0.35	3.36	223	1.28	6.87	0.50
				Pole	7½	0.32	2.33	------	1.19	5.60	−0.33	3.28	------	1.39	6.82	0.48
Wd 2	1.3 miles S. 25° W. of Cuttyhunk Light (41°23.7' N.; 70°57.8' W.).	Aug. 2–3, 1852	1	Float	0	(5)	2.90	67	0.18	------	(5)	2.46	250	0.88	------	0.21
				Pole	7½	(5)	------	------	0.46	------	(5)	2.41	------	1.21	------	------
Wd 3	1.1 miles N. 43° W. of Gay Head Light (41°21.7' N.; 70°51.1' W.).	July 24–25, 1852	1	Float	0	−0.35	2.30	16	1.36	7.36	0.76	2.66	262	2.31	5.06	0.42
				Pole	7½	−0.50	2.25	------	1.31	7.54	0.79	2.66	------	2.31	4.88	0.33
Wd 5	2.3 miles S. 19° E. of Tarpaulin Cove Light (41°26.0' N;. 70°44.5' W.).	Aug. 18–19, 1852	1	Float	0	0.00	2.70	34	0.75	6.51	0.26	3.16	210	1.15	5.91	0.61
				Pole	7½	0.07	2.70	------	1.24	6.34	0.16	3.16	------	1.34	6.08	0.60
Wd 6	0.4 mile N. 23° E. of West Chop Light (41°29.2' N.; 70°35.8' W.).	July 31–Aug. 1, 1852.	1	Float	0	0.25	2.77	82	2.96	5.69	−0.31	3.16	286	3.41	6.73	0.55
				Pole	10	0.25	2.73	------	2.99	5.69	−0.31	3.11	------	3.36	6.73	0.53
Wd 7	0.4 mile N. 35° E. of East Chop Light (41°28.5' N.; 70°33.8' W.).	Aug. 16–17, 1852	1	Float	0	−0.67	1.30	104	1.44	5.03	−1.89	2.11	302	0.69	7.39	11.72
				Pole	7½	−0.73	1.30	------	1.79	5.19	−1.79	2.41	------	1.04	7.23	11.80
Wd 8	1.8 miles N. 4° E. of East Chop Light (41°30.0' N.; 70°33.9' W.).	July 28–29, 1852	1	Float	0	0.40	3.25	77	1.66	6.48	0.63	3.06	272	1.46	5.94	0.92
				Pole	7½	0.45	3.40	------	1.95	6.66	0.86	3.01	------	1.60	5.76	1.01
Wd 9	2.8 miles N. 73° E. of East Chop Light (41°29.0' N.; 70°30.5' W.).	do	1	Float	0	0.40	3.40	62	1.05	6.11	0.26	3.26	282	1.35	6.31	0.91
				Pole	10	0.30	3.20	------	1.09	6.21	0.26	3.11	------	1.39	6.21	0.80
Wd 10	0.9 mile N. 16° E. of Cape Poge Light (41°26.1' N.; 70°26.8' W.).	Aug. 13–14, 1852	1	Float	0	0.75	2.95	78	0.99	6.49	0.99	3.56	315	0.69	5.93	1.14
				Pole	7½	0.80	3.05	------	0.94	6.51	1.06	3.66	------	0.64	5.91	1.22
Wd 12	1.3 miles S. 29° E. of Cape Poge Light (41°24.2' N.; 70°26.3' W.).	Aug. 14–15, 1852	1	Float	0	−1.23	1.05	10	1.02	6.39	−1.09	2.26	170	0.67	6.03	11.75
				Pole	5	−1.17	1.15	12	0.92	6.38	−1.04	2.11	173	0.77	6.04	11.76
Wd 16	6.8 miles S. 54° E. of Cape Poge Light (41°21.3' N.; 70°19.7' W.)	Aug. 17–18, 1852	1	Float	0	−0.57	2.30	58	1.16	5.93	−0.89	1.56	250	1.31	6.49	12.10
				Pole	7½	−0.60	2.25	------	1.17	6.01	−0.84	1.76	------	1.27	6.41	12.14
Wd 19	5.1 miles S. 79° W. of Bishop and Clerks Light (41°33.4' N.; 70°21.7' W.)	Aug. 24–25, 1852	1	Float	0	−0.10	3.30	59	1.39	6.51	0.16	3.01	306	1.09	5.91	0.68
				Pole	7½	−0.05	3.05	------	1.59	6.36	0.06	3.16	------	1.39	6.06	0.64
Wd 20	3.1 miles N. 84° W. of Monomoy Old Tower (41°33.9' N.; 70°03.8' W.)	Aug. 10–11, 1852	1½	Float	0	−2.17	1.83	109	0.74	6.90	−1.52	0.86	313	0.47	5.52	11.25
		Sept. 1–2, 1852		Pole	7½	−2.23	1.93	------	0.67	6.96	−1.52	0.53	------	0.51	5.46	11.18
Wd 22	2.1 miles S. 34° W. of Monomoy Old Tower (41°31.8' N.; 70°01.2' W.)	Aug. 28–29, 1852	1	Float	0	−1.60	1.05	132	1.85	6.36	−1.49	1.06	272	2.70	6.06	11.26
				Pole	7½	−1.63	0.80	------	2.00	6.39	−1.49	1.11	------	2.60	6.03	11.20
Wd 23	5.3 miles S. 43° E. of Bishop and Clerks Light (41°30.6' N.; 70°10.2' W.)	Aug. 9–10, 1852	1	Float	0	−1.10	3.50	69	0.99	7.64	0.29	3.16	292	0.84	4.78	0.54
				Pole	7½	−1.10	3.60	------	0.98	7.54	0.19	3.01	------	0.78	4.88	0.51
Wd 24	1.1 miles N. 39° W. of Great Point Light (41°24.3' N.; 70°03.7' W.)	Aug. 7–8, 1852	1	Float	0	−1.37	2.60	60	1.08	7.23	−0.39	2.76	251	1.43	5.19	12.40
				Pole	7½	−1.37	2.80	------	1.21	7.13	−0.49	2.66	------	1.66	5.29	12.40
Wd 25	6.3 miles N. 73° W. of Brant Point Light (41°19.3' N.; 70°13.5' W.)	Aug. 19–20, 1852	1	Float	0	−1.20	1.50	94	0.19	5.71	−1.74	1.56	312	0.24	6.71	11.53
				Pole	5	−1.27	1.40	------	0.14	5.58	−1.94	1.51	------	0.29	6.84	11.43
Wd 26	3.9 miles N. 39° E. of East Chop Light (41°31.3' N.; 70°30.8' W.)	Aug. 8–9, 1852	1	Float	0	−0.35	3.00	88	0.64	6.59	−0.01	2.26	299	0.69	5.83	0.31
				Pole	7½	−0.35	3.20	------	1.14	6.56	−0.04	2.26	------	1.19	5.86	0.35
Wd 27	2.6 miles N. 26° E. of West Chop Light (41°31.2' N.; 70°34.5' W.)	Aug. 12–13, 1852	1	Float	0	0.35	3.25	98	1.65	6.46	0.56	2.96	282	1.60	5.96	0.86
				Pole	7½	0.40	3.30	------	2.27	6.21	0.36	3.46	------	2.17	6.21	0.96
Wd 28	1.7 miles S. 40° W. of Monomoy Old Tower (41°32.2' N.; 70°01.1' W.)	Aug. 12, 1853	½	Float	0	−2.05	1.70	136	2.22	6.56	−1.74	1.06	294	1.42	5.86	11.24
				Pole	7½	−2.10	1.60	------	2.32	6.61	−1.74	1.16	------	1.52	5.81	11.23
Wd 29	4.9 miles S. 36° W. of Monomoy Old Tower (41°29.6' N.; 70°03.5' W.)	July 25–26, 1853	1	Float	0	−1.50	2.50	81	0.93	6.11	−1.64	0.86	258	1.38	6.31	11.56
				Pole	7½	−1.60	2.50	------	1.12	6.21	−1.64	1.01	------	1.27	6.21	11.57
	C. H. McBLAIR, 1852															
Mc 1	4.8 miles S. 11° E. of Cape Poge Light (41°20.6' N.; 70°25.9' W.)	Sept. 3, 1852	½	Float	0	0.00	2.99	16	2.52	6.61	0.36	2.36	183	2.42	5.81	0.51
Mc 2	1.3 miles S. 83° E. of Cape Poge Light (41°25.1' N.; 70°25.5' W.)	Sept. 9–10, 1852	½	do	0	−0.60	1.90	32	0.89	6.21	−0.64	3.06	213	0.99	6.21	0.01

See footnotes at end of table.

Table 10.—*Current Data, Nantucket and Vineyard Sounds, Strengths and Slacks—Continued*

Station no.	Observer, location, and year	Observations: Date	Period	Method	Depth	Slack	Flood strength: Time	True direction	Velocity	Flood duration	Slack	Ebb strength: Time	True direction	Velocity	Ebb duration	Mean current hour
	H. MITCHELL, 1857, 1863, 1871		*Days*		*Feet*	*Hours after low water*	*Hours after low water*	*Degrees*	*Knots*	*Hours*	*Hours after high water*	*Hours after high water*	*Degrees*	*Knots*	*Hours*	*Hours*
M-A	2.4 miles S. 29° W. of Tarpaulin Cove Light (41°26.0′ N.; 70°47.0′ W.).	July 5-6, 1857	1	Float	0	0.40	3.10	55	2.30	6.31	0.46	2.96	238	2.26	6.11	0.81
M-a	0.7 mile N. 38° E. of West Chop Light (41°29.4′ N.; 70°35.5′ W.).	July 6-7, 1857	½	do	0	−0.20	2.90	79	1.87	6.11	−0.34	2.46	328	2.57	6.31	0.29
M-B	2.3 miles N. 18° W. of Gay Head Light (41°23.1′ N.; 70°51.1′ W.).	do	¾	do	0	0.10	2.85	52	1.56	6.51	0.36	2.86	272	1.56	5.91	0.62
M-b	1.5 miles N. 14° E. of West Chop Light (41°30.4′ N.; 70°35.6′ W.).	July 8, 1857	½	do	0	0.50	3.50	100	2.71	6.51	0.76	3.06	271	2.31	5.91	1.04
M-C	2.3 miles N. 73° E. of East Chop Light (41°28.9′ N.; 70°31.1′ W.).	July 11-12, 1857	½	do	0	0.30	3.80	(6)	1.65	6.66	0.71	3.06	307	1.45	5.76	1.05
M-c	1.0 mile S. 67° E. of Nobska Point Light (41°30.6′ N.; 70°38.2′ W.).	July 9, 1857	½	do	0	−0.10	3.00	66	2.56	6.91	0.56	2.56	249	1.66	5.51	0.59
M-c₁	0.9 mile S. 60° E. of Nobska Point Light (41°30.5′ N. 70°38.4′ W.).	July 17, 1857	½	do	0	0.30	3.10	64	2.51	6.11	0.16	3.16	251	1.61	6.31	0.76
M-D	1.3 miles S. 58° E. of Cape Poge Light (41°24.6′ N.; 70°25.6′ W.).	July 12-14, 1857	2	do	0	−0.90	1.90	12	1.13	6.29	−0.86	1.98	191	1.03	6.13	12.03
M-d	0.6 mile N. 80° W. of West Chop Light (41°29.0′ N.; 70°36.8′ W.).	July 10, 1857	½	do	0	−1.30	2.50	55	2.36	7.81	0.26	1.36	233	1.16	4.61	12.21
M-E	2.0 miles N. 7° E. of Cape Poge Light (41°27.3′ N.; 70°26.8′ W.).	July 18-19, 1857	1	do	0	0.90	4.10	82	1.49	6.08	0.73	3.71	280	1.39	6.34	1.44
M-F	0.9 mile N. 86° W. of West Chop Light (41°28.9′ N.; 70°37.2′ W.)	July 24-25, 1857	1	do	0	−0.43	2.55	59	2.35	6.64	−0.04	2.56	248	1.60	5.78	0.24
M-f	1.5 miles S. 48° E. of Falmouth Cupola (41°31.6′ N.; 70°34.6′ W.).	July 13, 1857	½	do	0	0.10	3.10	84	2.42	6.31	0.16	2.56	259	2.32	6.11	0.56
M-G	1.4 miles N. 62° E. of West Chop Light (41°29.5′ N.; 70°34.4′ W.).	July 27, 1857	½	do	0	0.50	3.50	102	2.90	7.11	1.36	2.96	297	2.50	5.31	1.16
M-g	1.8 miles N. 45° E. of West Chop Light (41°30.2′ N., 70°34.3′ W.).	July 14, 1857	½	do	0	0.50	3.50	107	1.90	6.41	0.66	3.26	287	1.70	6.01	1.06
M-H	1.4 miles S. 22° E. of Nobska Point Light (41°29.7′ N., 70°38.7′ W.).	July 29-30, 1857	1	do	0	1.25	3.95	82	2.32	5.86	0.86	3.66	253	3.07	6.56	1.51
M-h	2.7 miles east of Tarpaulin Cove Light (41°28.2′ N., 70°41.9′ W.).	July 18, 1857	½	do	0	0.70	3.20	51	2.53	5.71	0.16	3.36	235	2.13	6.71	0.94
M-i	3.6 miles N. 29° E. of West Chop Light ((41°32.0′ N., 70°33.7′ W.).	July 22, 1857	½	do	0	0.10	2.90	81	1.41	6.01	−0.14	2.86	253	1.51	6.41	0.51
M-J	3.2 miles west of Monomoy Old Tower (41°33.6′ N., 70°03.9′ W.).	Aug. 7-8, 1857	1	do	0	−0.45	3.15	78	0.83	6.91	0.21	2.91	300	0.63	5.51	0.54
M-K	1.7 miles N. 66° W. of Monomoy Old Tower (41°34.3′ N., 70°01.7′ W.).	Aug. 9-10, 1857	1	do	0	−2.55	1.23	176	1.09	7.66	−1.14	1.31	348	0.59	4.76	11.22
M-L	4.6 miles S.70° W. of Monomoy Old Tower (41°32.0′ N., 70°05.4′ W.)	Aug. 12-13, 1857	¾	do	0	−2.20	1.95	102	1.11	7.61	−0.84	1.66	296	0.71	4.81	11.64
M-l₁	1.3 miles N. 68° W. of West Chop Light (41°29.3′ N., 70°37.6′ W.).	July 31, 1857	½	do	0	1.20	3.20	69	2.74	5.16	0.11	3.86	257	2.74	7.26	1.18
M-M	4.1 miles N. 33° W. of Monomoy Old Tower (41°37.0′ N., 70°02.6 W.).	Aug. 15-16, 1857	½	do	0	(7)										
M-m	1.6 miles N. 13° W. of Monomoy Old Tower (41°35.1′ N., 70°00.1′ W.).	Aug. 21, 1857	½	do	0	(8)										
M-o	1.3 miles S. 68° W. of Monomoy Old Tower (41°33.1′ N., 70°01.3′ W.).	Aug. 20, 1857	½	do	0	−2.90	2.30	171	2.26	8.01	−1.14	−0.14	350	0.96	4.41	11.03
M-P	1.5 miles N. 3° W. of East Chop Light (41°29.7′ N., 70°34.2′ W.).	Aug. 25-26, 1857	½	do	0	0.60	3.50	102	2.14	6.56	0.91	3.16	287	2.14	5.86	1.12
M-p	1.4 miles N. 11°E. of East Chop Light (41°29.6′ N., 70°33.7′ W.).	July 30, 1857	½	do	0	0.60	3.70	114	2.07	6.61	0.96	3.46	273	2.07	5.81	1.26
M-Q	3.5 miles N. 67° E. of East Chop Light (41°29.6′ N., 70°29.8′ W.).	Aug. 26, 1857	½	do	0	0.60	3.00	90	1.35	6.01	0.36	3.56	291	1.25	6.41	0.96
M-r	2.0 miles N. 16° E. of East Chop Light (41°30.2′ N., 70°33.3′ W.)	July 26, 1857	½	do	0	0.35	3.00	100	1.61	6.56	0.66	2.86	281	1.81	5.86	0.80
M-v	2.0 miles S. 71° E. of East Chop Light (41°27.6′ N., 70°31.6′ W.)	Aug. 3, 1857	½	do	0	0.80	3.60	128	0.99	6.31	0.86	4.06	296	1.59	6.11	1.41
M 1	3.8 miles N. 31° W. of Great Point Light (41°26.7′ N., 70°05.4′ W.)	July 5-7, 1857	2	do	0	−0.75	2.85	97	1.36	6.38	−0.62	2.39	266	1.34	6.04	0.05
M 2	7.5 miles N. 75° E. of Cape Poge Light (41°27.2′ N., 70°17.4′ W.).	July 8-9, 1857	½	do	0	0.10	3.40	78	1.47	6.21	0.06		262	1.37	6.21	0.78
M 3	0.9 mile S. 6° W. of Old Tower, Point Gammon (41°35.7′ N., 70°16.1′ W.).	July 12-13, 1857	½	do	0	−0.80	1.70	102	0.62	6.41	−0.64	2.16	262	0.92	6.01	12.11
M 4	2.0 miles S. 1° W. of Bishop and Clerks Light (41°32.4′ N., 70°15.1′ W.).	July 13-14, 1857	½	do	0	0.00	3.40	96	1.04	6.01	−0.24	2.46	262	0.94	6.41	0.49
M 5	3.7 miles N. 80° E. of Cape Poge Light (41°25.9′ N., 70°22.2′ W.).	July 17-18, 1857	½	do	0	0.20	2.80	52	1.16	5.41	−0.64	3.16	246	1.46	7.01	0.46
M 6	5.4 miles S. 12° E. of Cape Poge Light (41°20.0′ N., 70°25.6′ W.).	July 19-20, 1857	¾	do	0	0.20	2.30	14	3.51	5.61	−0.44	2.36	217	3.71	6.81	0.19
M 7	6.8 miles N. 10° E. of Cape Poge Light (41°32.0′ N., 70°25.6′ W.).	July 27, 1857	½	do	0	−0.20	3.30	65	1.76	6.91	0.46	3.06	270	1.36	5.51	0.74
M 8	4.8 miles S. 71° E. of Bishop and Clerks Light (41°32.9′ N., 70°09.0′ W.).	Aug. 3-4, 1857	1	do	0	0.55	3.60	80	0.90	6.71	1.01	2.66	296	0.85	5.71	1.04
M 11	6.7 miles N. 30° W. of Great Point Light (41°29.2′ N., 70°07.2′ W.).	Aug. 15-16, 1857	½	do	0	−1.00	3.00	97	1.27	6.81	−0.44	2.06	265	1.27	5.61	12.41
M 32	1.7 miles S. 36° W. of Monomoy Old Tower (41°32.2′ N., 70°01.0′ W.)	Aug. 9-10, 1857	1	do	0	−1.93	1.70	141	1.68	6.79	−1.39	1.11	288	1.48	5.63	11.38
M 33	1.1 miles N. 60° W. of Bishop and Clerks Light (41°35.0′ N., 70°16.3′ W.).	Sept. 3-4, 1857	½	do	0	−1.30	1.80	84	0.93	6.91	−0.64	2.36	279	0.93	5.51	12.06
Mi 2	1.2 miles N.72° E. of East Chop Light (41°28.6′ N., 70°32.5′ W.).	July 28, 1863	½	Can	7¾	0.90	3.30	110	1.68	6.16	0.81	4.46	300	1.88	6.26	1.45
Mt 3	3.4 miles S. 85° E. of Nobska Point Light (41°30.7′ N ,70°34.8′ W.).	July 30-31, 1871	1	Float Can	0 7½	0.20 0.15	2.95 3.20	87 82	2.36 2.74	6.36 6.41	0.31 0.31	2.86 2.76	282 282	1.96 2.19	6.06 6.01	0.66 0.69

See footnotes at end of table.

Station no.	Observer, location, and year	Observations: Date	Period	Method	Depth	Slack	Flood strength: Time	True direction	Velocity	Flood duration	Slack	Ebb strength: Time	True direction	Velocity	Ebb duration	Mean current hour
	E. F. HICKS, 1934 [9]		*Days*		*Feet*	*Hours after low water*	*Hours after low water*	*Degrees*	*Knots*	*Hours*	*Hours after high water*	*Hours after high water*	*Degrees*	*Knots*	*Hours*	*Hours*
H 1	3.3 miles N. 14° W. of Gay Head Light (41°24.1′ N.; 70°51.2′ W.).	Aug. 27–30	3	Pole	7	0.24	2.70	74	1.08	6.21	0.20	2.30	255	1.26	6.21	0.45
				Meter	16	0.04	2.76		1.07	6.34	0.13	2.33		1.19	6.08	0.41
				do	40	0.16	2.66		1.05	6.26	0.17	2.63		0.91	6.16	0.50
				do	64	−0.06	2.46		0.93	6.18	−0.13	2.65		0.80	6.24	0.32
H 2	1.6 miles N. 55° W. of Gay Head Light (41°21.8′ N.; 70°51.8′ W.).	do	3	Pole	7	−0.57	2.26	12	1.99	6.79	−0.03	2.30	249	2.06	5.63	0.08
				Meter	13	−0.57	2.18		2.02	6.75	−0.07	2.30		1.94	5.67	0.05
				do	33	−0.70	2.12		1.77	6.82	−0.13	2.30		1.70	5.60	12.41
				do	53	−0.68	2.00		1.40	6.50	−0.43	2.40		1.37	5.92	12.34
H 3	2.3 miles S. 27° W. of Tarpaulin Cove Light (41°26.1′ N.; 70°46.8′ W.).	Aug. 30–Sept. 6	3	Pole	7, 8	0.48	3.17	60	1.96	6.17	0.40	3.07	240	2.07	6.25	0.87
				Meter	15	0.38	3.20		1.94	6.32	0.45	3.05		2.11	6.10	0.86
				do	38	0.32	3.20		1.83	6.31	0.38	3.28		1.78	6.11	0.89
				do	60	0.33	3.08		1.70	6.24	0.32	3.50		1.52	6.18	0.90
H 4	3.3 miles N. 47° E. of Gay Head Light (41°23.1′ N.; 70°47.0′ W.).	Aug. 27–30	3	Pole	7	0.34	3.20	81	0.93	5.79	−0.12	3.20	238	1.35	6.63	0.75
				Meter	19	0.36	3.12		0.97	5.89	0.00	3.22		1.24	6.53	0.77
				do	48	0.24	2.76		0.90	5.88	−0.13	3.22		1.02	6.54	0.62
				do	77	0.28	2.80		0.77	5.82	−0.15	3.40		0.78	6.60	0.68
H 6	1.4 miles N. 83° E. of Tarpaulin Cove Light (41°28.3′ N.; 70°43.5′ W.).	Aug. 30–Sept. 8	3	Pole	7	0.76	3.46	55	1.97	5.94	0.45	3.55	232	2.35	6.48	1.15
				Meter	12, 14	0.74	3.44		1.87	5.96	0.45	3.62		2.24	6.46	1.16
				do	30, 36	0.72	3.48		1.83	6.03	0.50	3.62		2.15	6.39	1.17
				do	48, 58	0.74	3.50		1.70	5.96	0.45	3.68		1.97	6.46	1.18
H 7	0.9 mile N. 35° W. of Norton Point Cupola (41°28.1′ N.; 70°39.9′ W.).	do	3	Pole	7	−0.12	3.02	50	3.44	6.67	0.30	2.25	240	2.44	5.75	0.46
				Meter	11	−0.20	3.10		3.36	6.67	0.22	2.20		2.41	5.75	0.42
				do	27	−0.12	3.03		3.20	6.62	0.25	2.20		2.32	5.80	0.43
				do	43	−0.16	3.08		3.14	6.71	0.30	2.10		2.14	5.71	0.42
H 8	1.0 mile S. 35° E. of Nobska Point Light (41°30.1′ N.; 70°38.6′ W.).	Sept. 4–8	3	Pole	7	0.42	3.62	71	2.64	6.53	0.70	3.28	259	2.44	5.89	1.10
				Meter	14, 16	0.52	3.55		2.56	6.36	0.63	3.43		2.40	6.06	1.12
				do	36, 39	0.43	3.65		2.49	6.52	0.70	3.37		2.30	5.90	1.13
				do	58, 62	0.47	3.72		2.24	6.43	0.65	3.35		2.05	5.99	1.14
H 9	0.4 mile N. 70° W. of West Chop Light (41°29.0′ N.; 70° 36.6′ W.).	Sept. 4–7	3	Pole	7	−0.68	2.98	59	2.75	7.05	0.12	2.33	241	1.40	5.37	0.28
				Meter	9	−0.83	2.83		2.55	7.12	0.04	2.25		1.47	5.30	0.16
				do	23	−0.85	2.88		2.45	7.20	0.10	2.37		1.74	5.22	0.22
				do	37	−0.80	2.88		1.32	7.23	0.18	2.62		1.67	5.19	0.31
H 10	*1.7 miles N. 85° E. of Nobska Point* Light (41°31.1′ N.; 70°37.1′ W.).	*July 30–Aug. 2*	3	Pole	7	0.18	3.08	63	2.46	6.24	0.17	2.86	240	1.81	6.18	0.66
				Meter	8	0.10	3.07		2.19	6.32	0.17	2.82		1.55	6.10	0.63
				do	20	0.13	3.13		1.97	6.35	0.23	2.94		1.67	6.07	0.70
				do	32	0.12	3.15		1.64	6.35	0.22	2.78		1.54	6.07	0.66
H 11	0.8 mile N. 21° E. of West Chop Light (41°29.6′ N.; 70°35.7′ W.).	Aug. 2–8	2½	Pole	7	0.72	3.26	96	3.06	6.13	0.60	3.70	282	2.98	6.29	1.16
				Meter	16	0.76	3.34		3.09	6.05	0.56	3.52		3.01	6.37	1.14
				do	41	0.66	3.34		3.00	6.19	0.60	3.54		2.80	6.23	1.13
				do	66	0.60	3.32		2.84	6.25	0.60	3.76		2.64	6.17	1.16
H 13	1.5 miles S. 48° E. of Falmouth Cupola (41°31.6′ N.; 70°34.6′ W.).	Aug. 2–10	3	Pole	7	0.48	3.36	80	2.29	6.20	0.43	3.18	268	2.28	6.22	0.96
				Meter	14, 18	0.38	3.40		2.31	6.35	0.48	3.26		2.26	6.07	0.97
				do	36, 42	0.37	3.48		2.14	6.36	0.48	3.28		2.06	6.06	1.00
				do	58, 67	0.37	3.44		1.97	6.35	0.47	3.50		1.82	6.07	1.04
H 14	1.0 mile N. 28° E. of East Chop Light (41°29.1′ N.; 70°33.5′ W.).	July 30–Aug. 2	3	Pole	7	0.68	3.13	116	2.20	6.10	0.53	3.24	297	2.26	6.32	0.99
				Meter	14, 16	0.52	3.28		2.16	6.25	0.52	3.20		2.19	6.17	0.97
				do	35, 40	0.52	3.28		2.05	6.15	0.42	3.08		2.06	6.27	0.92
				do	56, 64	0.40	3.30		1.89	6.15	0.30	3.28		1.89	6.27	0.91
H 15	Entrance to Waquoit Bay (41°32.9′ N.; 70°31.8′ W.).	Sept. 20–28	3	Pole	4	1.34	3.47	348	1.56	6.69	1.78	5.11	203	1.54	5.73	2.02
				Meter	2	1.22	3.65		1.47	7.07	2.04	4.97		1.21	5.35	2.06
				do	5, 6	1.14	3.50		1.79	7.13	2.02	4.99		1.14	5.29	2.00
H 16	2.5 miles N. 33° E. of East Chop Light (41°30.3′ N.; 70°32.2′ W.).	Aug. 2–17	3	Pole	7	0.38	2.85	106	2.11	6.10	0.23	2.85	276	2.13	6.32	0.67
				Meter	10	0.37	3.07		2.17	6.18	0.30	2.95		2.18	6.24	0.76
				do	24, 26	0.42	3.08		2.02	6.13	0.30	3.08		2.11	6.29	0.81
				do	38, 42	0.28	3.12		1.82	6.17	0.20	3.28		1.91	6.25	0.81
H 17	1.4 miles S. 76° E. of East Chop Light (41°27.9′ N.; 70°32.2′ W.).	Aug. 20–23	3	Pole	7	0.08	2.30	131	1.47	6.19	0.02	3.10	329	1.88	6.23	0.47
				Meter	7	0.03	2.28		1.40	6.18	−0.04	3.07		1.80	6.24	0.43
				do	18	0.05	2.15		1.35	6.12	−0.08	3.12		1.63	6.30	0.40
				do	29	0.13	2.30		1.09	5.82	−0.30	3.00		1.38	6.60	0.38
H 20	Entrance to Cotuit Bay, southeast of Bluff Point (41°36.6′ N.; 70°25.8′ W.).	Sept. 17–20	3	Pole	4	0.73	3.88	35	0.51	6.66	1.14	4.59	218	0.67	5.76	1.68
				Meter	2	0.63	3.87		0.56	6.66	1.04	4.79		0.73	5.76	1.68
				do	5	0.62	3.88		0.54	6.73	1.10	4.49		0.67	5.69	1.62
H 21	Between Wreck Shoal and Eldridge Shoal (41°32.0′ N; 70°25.7′ W.).	Sept. 10–13	3	Pole	7	−0.10	2.80	62	1.81	6.27	−0.08	2.80	245	1.47	6.15	0.45
				Meter	7	−0.53	2.90		1.59	6.80	0.02	2.73		1.32	5.62	0.37
				do	18	−0.25	2.90		1.67	6.50	0.00	2.80		1.45	5.92	0.46
				do	29	−0.10	3.02		1.49	6.30	−0.05	2.85		1.27	6.12	0.52
H 22	1.7 miles S. 43° E. of Cape Poge Light (41°24.0′ N.; 70°25.6′ W.).	Aug. 6–11	3	Pole	7	−0.75	1.60	6	1.87	6.30	−0.70	1.83	178	1.61	6.12	12.01
				Meter	4, 5	−0.72	1.65		1.64	6.12	−0.85	1.98		1.50	6.30	12.03
				do	11, 13	−0.90	1.73		1.81	6.40	−0.75	2.03		1.50	6.02	12.04
				do	18, 20	−0.97	1.78		1.60	6.42	−0.80	2.02		1.30	6.00	12.02
H 23	Muskeget Channel, 1.4 miles eastward of Wasque Point (41°20.9′ N.; 70°25.2′ W.).	Aug. 8–11	3	Pole	7	−0.47	2.03	21	3.84	6.47	−0.25	2.02	200	3.29	5.95	12.34
				Meter	9	−0.35	1.88		3.70	6.32	−0.28	2.13		3.34	6.10	12.36
				do	23	−0.45	1.98		3.77	6.46	−0.24	2.08		3.25	5.96	12.36
				do	38	−0.58	1.97		3.53	6.59	−0.24	2.22		2.97	5.83	12.36
H 24	5.8 miles N. 36° E. of Cape Poge Light (41°29.9′ N.: 70°22.6′ W.).	July 30–Aug. 2	3	Pole	7	−0.40	3.15	83	1.45	6.55	−0.10	2.15	260	0.96	5.87	0.29
				Meter	4	−0.48	2.97		1.40	6.61	−0.12	2.23		0.96	5.81	0.24
				do	15	−0.42	3.10		1.31	6.54	−0.13	2.35		0.94	5.88	0.32
H 26	Between Norton Shoal and Long Shoal (41°25.0′ N.; 70°20.0′ W.).	Aug. 6–21	3	Pole	7	−0.55	2.05	70	1.65	6.62	−0.18	2.32	248	1.75	5.80	0.00
				Meter	12	−0.58	2.18		1.61	6.70	−0.13	2.40		1.61	5.72	0.06
				do	31	−0.48	2.05		1.55	6.45	−0.28	2.45		1.47	5.97	0.03
				do	50	−0.78	2.37		1.37	6.66	−0.37	2.60		1.24	5.76	0.05

See footnotes at end of table.

TABLE 10.—*Current Data, Nantucket and Vineyard Sounds, Strengths and Slacks*—*Continued*

Station no.	Observer, location, and year	Observations				Slack	Flood strength			Flood duration	Slack	Ebb strength			Ebb duration	Mean current hour
		Date	Period	Method	Depth		Time	True direction	Velocity			Time	True direction	Velocity		
	E. F. HICKS, 1934 [9]—Continued		*Days*		*Feet*	*Hours after low water*	*Hours after low water*	*Degrees*	*Knots*	*Hours*	*Hours after high water*	*Hours after high water*	*Degrees*	*Knots*	*Hours*	*Hours*
H 27	Dredged Channel Entrance to Lewis Bay (41°37.9′ N.; 70°16.4′ W.).	Sept. 24–27	3	Pole	4	0.72	2.14	4	0.96	6.43	0.90	5.40	184	1.36	5.99	1.38
				Meter	2	0.73	2.20		0.95	6.40	0.88	5.40		1.32	6.02	1.40
				do	7	0.62	2.30		0.92	6.78	1.15	5.39		1.18	5.64	1.46
H 28	Hyannis Harbor 0.8 mile S. 37° E. of Hyannisport Tower (41°37.4′ N.; 70°17.5′ W.).	do	3	Pole	7	(10)										
				Meter	3											
				do	13											
H 29	0.9 mile N. 18° W. of Bishop and Clerks Light (41°35.3′ N.; 70°15.4′ W.).	Sept. 10–14	3	Pole	7	–0.72	2.28	105	1.04	6.30	–0.67	2.00	260	1.00	6.12	12.24
				Meter	5	–0.88	2.42		1.04	6.51	–0.62	2.12		1.02	5.91	12.27
				do	11, 12	–0.88	2.40		1.14	6.48	–0.65	2.08		1.03	5.94	12.25
				do	18, 19	–0.85	2.65		1.04	6.47	–0.63	2.10		1.00	5.95	12.33
H 31	1.1 miles N. 56° E. of Muskeget Island Cupola (41°21.0′ N.; 70°17.1′ W.).	Aug. 8–11	3	Pole	7	–0.63	2.08	108	1.02	6.08	–0.80	1.92	295	1.56	6.34	12.16
				Meter	4	–0.67	2.05		1.09	6.19	–0.73	1.94		1.54	6.23	12.16
				do	11	–0.47	2.07		1.04	5.82	–0.90	2.06		1.43	6.60	12.20
				do	18	–0.48	2.25		0.90	5.83	–0.90	2.12		1.24	6.59	12.26
H 33	2.6 miles N. 39° W. of Nantucket Water Tower (41°19.3′ N.; 70°10.2′ W.).	Aug. 20–23	3	Pole	7	–0.97	2.48	94	0.52	6.64	–0.58	2.28	284	0.35	5.78	12.32
				Meter	7	–0.74	2.58		0.68	6.13	–0.86	2.27		0.51	6.29	12.32
				do	17	–0.86	2.53		0.61	6.23	–0.88	2.10		0.55	6.19	12.24
				do	26	–0.88	2.27		0.58	6.15	–0.98	2.27		0.45	6.27	12.18
H 35	3.4 miles eastward of Halfmoon Shoal (42°28.1′ N.; 70°09.2′ W.).	July 25–28	3	Pole	6¾	–1.00	2.75	88	1.05	6.61	–0.64	2.26	295	0.92	5.81	12.36
				Meter	8	–0.73	2.72		1.15	6.46	–0.52	2.16		1.08	5.96	0.00
				do	19	–0.82	2.67		1.05	6.29	–0.78	2.24		1.06	6.13	12.34
				do	30	–0.68	2.68		0.94	6.13	–0.80	2.14		1.04	6.29	12.35
H 36	3.0 miles west of Great Point Light (41°23.4′ N.; 70°06.8′ W.).	July 23–28	3	Pole	7	–1.02	2.62	66	0.72	6.39	–0.88	2.25	248	0.74	6.03	12.26
				Meter	8, 9	–0.62	2.82		0.85	5.95	–0.92	2.08		0.91	6.47	12.35
				do	20, 22	–0.44	2.94		0.78	5.69	–1.00	2.15		0.84	6.73	0.00
				do	32, 35	–0.50	3.06		0.67	5.55	–1.20	2.25		0.90	6.87	0.00
H 37	Nantucket Harbor entrance, 1.0 mile N. 22° W. of Brant Point Light (41°18.4′ N.; 70°06.0′ W.).	Aug. 20–25	3	Pole	3½, 7	1.35	3.27	171	1.18	5.87	0.97	5.04	350	1.56	6.55	1.75
				Meter	2, 4	1.25	3.22		1.17	6.00	1.00	4.95		1.50	6.42	1.70
				do	7, 15	1.22	3.15		1.23	6.01	0.98	4.99		1.49	6.41	1.68
H 38	Stage Harbor entrance, 0.4 mile S. 70° E. of Harding Beach Tower (41°39.4′ N.; 69°58.5′ W.).	Sept. 19–22	3	Pole	4	0.90	2.75	335	0.50	5.95	0.60	5.59	144	1.04	6.47	1.55
				Meter	2	1.13	2.77		0.51	5.76	0.64	5.59		1.11	6.66	1.62
				do	10	1.08	2.95		0.46	5.85	0.68	5.29		0.83	6.57	1.59
H 39	Chatham Roads, 2.2 miles S. 65° W. of Harding Beach Tower (41°38.6′ N.; 70°01.7′ W.).	Aug. 13–19	3	Pole	7	(10)										
				Meter	6, 7											
				do	16, 17											
				do	26, 27											
H 40	3.3 miles N. 82° W. of Old Tower, Monomoy Point (41°34.0′ N.; 70°04.0′ W.).	Sept. 17–20	3	Pole	7	–2.96	2.12	124	0.61	7.86	–1.35	0.80	300	0.46	4.56	11.16
				Meter	4	(11)										
				do	11											
				do	17											
H 41	1.4 miles S. 66° W. of Old Tower, Monomoy Point (41°33.0′ N.; 70°01.3′ W.).	Aug. 13–Sept. 22	3	Pole	8	–2.03	2.00	170	1.77	6.85	–1.43	0.58	346	2.09	5.57	11.29
				Meter	7	–2.10	1.96		1.65	6.88	–1.47	0.72		1.95	5.54	11.29
				do	20, 21	–2.03	1.80		1.60	6.73	–1.55	0.78		1.95	5.69	11.26
				do	32, 33	–2.05	1.84		1.42	6.75	–1.55	0.66		1.80	5.67	11.24
H 42	0.7 mile N. 73° W. of Great Point Light (41°23.6′ N.; 70°03.7′ W.).	July 23–28	3	Pole	6¾, 7	–1.68	2.93	29	1.10	7.39	–0.54	1.64	195	1.14	5.03	12.10
				Meter	10	–1.63	2.97		1.12	7.36	–0.52	1.52		1.23	5.06	12.10
				do	25	–1.32	2.97		0.98	6.79	–0.78	1.54		1.22	5.63	12.12
				do	40	–1.25	2.83		0.79	6.68	–0.82	1.66		1.10	5.74	12.12
H 44	Pollock Rip Channel, 3.2 miles N. 84° E. of old tower, Monomoy Point (41°33.9′ N.; 69°55.4′ W.).	Aug. 14–17	3	Pole	7	–2.23	0.65	53	2.08	6.40	–2.08	0.40	212	1.95	6.02	10.70
				Meter	8	–2.32	0.67		1.92	6.39	–2.18	0.46		1.54	6.03	10.67
				do	21	–2.37	0.70		1.98	6.49	–2.13	0.34		1.87	5.93	10.65
				do	33	–2.30	0.75		1.72	6.33	–2.22	0.10		1.80	6.09	10.60

1 Current flowed northward throughout period of observations, direction varying from 315° to 76°. Maximum velocity 0.6 knot setting 72° true.
2 Current weak, maximum observed velocity 0.3 knot eastward.
3 Current weak, maximum observed velocity 0.1 knot.
4 Current weak, maximum observed velocity 0.4 knot setting 58° true.
5 Times of slack indefinite.
6 Direction not observed.
7 Current weak, maximum velocity 0.4 knot, 114° true.
8 Current weak, maximum velocity observed 0.2 knot southward.
9 For stations by Hicks not included in this table, see tables 11 and 14.
10 Current weak and irregular. Maximum velocity observed by pole=0.4 knot.
11 Times of slacks and strengths at meter depths are indefinite.

For reference to above table, see p. 74.

105215 O—38——7

TABLE 11.—*Current Data, Nantucket and Vineyard Sounds, Strengths and Minimums*

[Referred to times of high water and low water at Commonwealth Piers, Boston]

Station no.	Observer, location, and year	Observations			Minimum before flood			Flood strength			Flood duration	Minimum before ebb			Ebb strength			Ebb duration	Mean current hour	Nontidal current	
		Method	Depth	Period	Time	True direction	Velocity	Time	True direction	Velocity		Time	True direction	Velocity	Time	True direction	Velocity				
	E. F. HICKS, 1934		*Feet*	*Days*	*Hours after low water*	*Degrees*	*Knots*	*Hours after low water*	*Degrees*	*Knots*	*Hours*	*Hours after high water*	*Degrees*	*Knots*	*Hours after high water*	*Degrees*	*Knots*	*Hours*	*Hours*	*Degrees*	*Knots*
H 5	Menemsha Bight, 0.2 mile westward of Menemsha Pond entrance (41°21.3′N.; 70°46.3′W.), Aug. 29–31.	Pole	7	1½	−2.00	353	0.11	1.50	81	0.32	6.75	−1.50	117	0.16	−0.40	304	0.71	5.67	10.91	339	0.17
		Meter	4		−2.00		0.30	1.50		0.33	5.45	−2.80		0.20	−0.30		0.96	6.97	10.61		
		do	15		−2.90		0.27	2.00		0.37	7.55	−1.60		0.17	−0.40		0.76	4.87	10.79		
H 12	Vineyard Haven, 0.9 mile S. 84° W. of East Chop Light (41°28.1′ N.; 70°35.2′ W.), Aug. 22–25.	Pole	7	3	1.20	184	0.16	5.45	273	0.28	8.95	1.50	95	0.06	5.67	116	0.27	3.47	3.50	180	0.03
		Meter	5		1.50		0.22	5.85		0.36	9.25	1.50		0.21	5.97		0.39	3.17	3.60		
		do	12		1.20		0.20	5.75		0.34	9.35	1.90		0.19	5.47		0.34	3.07	3.62		
		do	18		1.20		0.19	5.75		0.30	9.35	1.90		0.19	4.77		0.28	3.07	3.45		
H 18	Edgartown Harbor, 1.4 miles N. 84° W. of Cape Poge Light (41°25.4′ N.; 70°29.0′ W.), Aug. 21–25.	Pole	7	3	0.20	268	0.06	2.90	91	0.34	6.05	0.00	247	0.06	2.60	252	0.27	6.37	0.52		0.00
		Meter	7		0.40		0.26	3.00		0.40	5.25	−0.60		0.24	2.40		0.42	7.17	0.39		
		do	18		0.10		0.21	3.30		0.34	5.45	−0.70		0.23	2.10		0.37	6.97	0.29		
		do	29		0.10		0.20	3.60		0.31	5.25	−0.90		0.22	2.50		0.36	7.17	0.42		
H 25	3.4 miles N. 48° E. of Cape Poge Light (41°27.5′ N.; 70°23.8′ W.), Aug. 8–17.	Pole	7	3	0.90	33	0.16	3.75	94	1.10	5.85	0.50	180	0.16	3.07	268	1.13	6.57	1.15	49	0.20
		Meter	13		0.70		0.47	3.95		1.31	6.05	0.50		0.36	3.67		0.96	6.37	1.30		
		do	33		0.40		0.31	4.05		1.23	6.45	0.60		0.38	3.37		0.97	5.97	1.20		
		do	53		0.30		0.34	3.95		1.03	6.75	0.80		0.38	3.87		0.76	5.67	1.32		
H 30	2.2 miles S. 46° W. of Bishop and Clerks Light (41°33.0′ N.; 70°17.1′ W.), Sept. 10–14.	Pole	7	3	−0.30	0	0.23	3.25	107	1.08	6.05	−0.50	224	0.12	2.37	276	0.93	6.37	0.30	147	0.20
		Meter	5, 6		−0.80		0.42	3.45		1.17	6.75	−0.30		0.53	2.47		0.90	5.67	0.30		
		do	12, 14		−0.70		0.37	3.35		1.20	6.65	−0.30		0.47	2.37		0.90	5.77	0.27		
		do	19, 22		−0.50		0.35	3.35		1.08	6.45	−0.30		0.42	2.57		0.87	5.97	0.37		
H 32	5.8 miles N. 81° W. of Great Point Light (41°24.3′ N.; 70°10.4′W.), July 23–26.	Pole	7	3	−0.70	0	0.28	2.90	113	0.94	6.35	−0.60	186	0.30	2.20	287	0.88	6.07	0.04	74	0.03
		Meter	5		−0.80		0.46	2.80		0.92	6.45	−0.60		0.56	2.20		0.85	5.97	12.41		
		do	12		−0.90		0.44	2.80		1.01	6.45	−0.70		0.53	2.20		0.96	5.97	12.36		
		do	20		−0.90		0.42	2.90		0.98	6.55	−0.60		0.52	2.30		0.85	5.87	0.02		
H 34	2.4 miles south of Herring River mouth (41°37.0′ N.; 70°06.9′ W.), Sept. 18–21.	Pole	7	3	−0.60	138	0.07	2.20	77	0.32	5.55	−1.30	52	0.08	2.10	269	0.30	6.87	12.11	120	0.06
		Meter	6		−0.40		0.25	2.20		0.45	5.95	−0.70		0.26	2.10		0.35	6.47	12.31		
		do	15		−1.10		0.22	2.60		0.44	6.55	−0.80		0.23	2.20		0.35	5.87	12.24		
		do	24		−1.10		0.26	2.30		0.39	6.35	−1.00		0.23	1.70		0.32	6.07	11.99		
H 43	Great Round Shoal Channel, 3.9 miles N. 45° E. of Great Point Light (41°26.2′ N.; 69°59.0′ W.), July 24–27.	Pole	7	3	−1.00	345	0.17	3.20	98	1.27	6.75	−0.50	173	0.35	2.10	273	1.43	5.67	0.04	50	0.44
		Meter	12		−1.30		0.58	3.10		1.46	7.45	−0.10		0.48	2.10		1.23	4.97	0.04		
		do	30		−1.30		0.51	3.10		1.39	7.25	−0.30		0.58	2.10		1.16	5.17	12.41		
		do	48		−1.30		0.46	3.20		1.23	7.15	−0.40		0.56	2.10		1.03	5.27	12.41		
H 45	4.6 miles S. 78° E. of Bishop and Clerks Light (41°33.5′ N.; 70°09.0′ W.), Sept. 11–14.	Pole	7	3	−0.70	194	0.06	3.20	90	0.48	6.35	−0.60	334	0.08	2.40	275	0.48	6.07	0.17	225	0.08
		Meter	8		−0.50		0.38	3.20		0.72	5.95	−0.80		0.45	2.20		0.67	6.47	0.12		
		do	21		−0.70		0.40	3.10		0.75	6.15	−0.80		0.42	2.00		0.66	6.27	12.41		
		do	34		−1.30		0.40	3.00		0.69	6.75	−0.80		0.43	1.60		0.62	5.67	12.14		
H 46	Eastern end of Great Round Shoal Channel (41°26.4′ N.; 69°44.3′ W.), Aug. 14–16.	Pole	7	2	−1.70	283	0.83	1.50	33	1.59	6.95	−1.00	139	0.94	1.60	208	1.50	5.47	11.61	135	0.40
		Meter	8		−1.50		0.79	3.00		1.68	7.05	−0.70		1.40	1.10		1.77	5.37	11.99		
		do	21		−1.30		0.69	3.00		1.56	6.95	−0.60		1.85	1.30		1.64	5.47	12.11		
		do	34		−1.30		0.62	3.60		1.40	6.95	−0.60		1.20	1.30		1.56	5.47	12.26		
H 46A	Eastern end of Great Round Shoal Channel (41°25.8′ N.; 69°45.5′ W.), Sept. 11–12.	Pole	7	1	−1.50	290	0.58	1.70	36	1.69	6.75	−1.00	142	0.72	1.50	220	1.75	5.67	11.69	142	0.37
		Meter	10		−1.10		0.43	1.80		1.65	6.25	−1.10		0.87	1.30		1.75	6.17	11.74		
		do	24		−1.30		0.48	1.90		1.55	6.55	−1.00		0.87	1.10		1.65	5.87	11.69		
		do	38		−1.40		0.34	1.70		1.26	6.85	−0.80		0.68	1.00		1.55	5.57	11.64		

Values for pole are tidal current corrected for range (nontidal current eliminated).
Values for meter are corrected for range by applying range factor direct to observed velocities.
For reference to above table, see p. 75.

TABLE 12.—***Current Data, Nantucket Sound Lightships, Strengths and Slacks***

[Referred to times of high water and low water at Commonwealth Piers, Boston]

Station no.	Location	Observations				Flood strength				Flood duration	Ebb strength				Ebb duration	Mean current hour
		Date	Period	Method	Depth	Slack	Time	True direction	Velocity		Slack	Time	True direction	Velocity		
			Days		*Feet*	*Hours after low water*	*Hours after low water*	*Degrees*	*Knots*	*Hours*	*Hours after high water*	*Hours after high water*	*Degrees*	*Knots*	*Hours*	*Hours*
L 2	Hedge Fence Lightship (41°28.3′ N.; 70°29.0′ W.).	September-December 1913	87	Pole	7	0.73	3.90	108	1.36	6.41	0.89	3.77	268	1.24	6.01	1.40
L 3	Cross Rip Lightship (41°26.9′ N.; 70°17.5′ W.).	do	87	do	7	−0.09	3.26	102	1.35	6.61	0.27	3.10	271	0.98	5.81	0.72
		August 1934-August 1935	385	do	7	−0.27	3.14	91	1.29	6.70	0.18	3.03	272	0.93	5.72	0.60
L 4	Handkerchief Lightship (41°29.3′ N.; 70°04.0′ W.).	June-September 1911	87	do	7	−0.97	2.41	94	1.76	6.35	−0.87	1.79	243	1.66	6.07	12.09
		August 1934-August 1935	390	do	7	−0.93	2.51	80	1.25	6.26	−0.92	2.02	251	1.28	6.16	12.17
L 5	Shovelful Shoal Lightship (41°32.7′ N.; 69°59.3′ W.).	September-December 1913	87	do	7	−1.80	1.33	52	1.98	6.23	−1.82	1.19	227	2.29	6.19	11.23
L 6	Stone Horse Shoal Lightship (41°32.4′ N.; 69°59.2′ W.).	December 1918-August 1919	255	do	7	−1.86	1.44	60	2.55	6.56	−1.55	1.28	240	2.44	5.86	11.33
L 7	Stone Horse Shoal Lightship (41°32.8′ N.; 69°59.1′ W.).	August 1934-January 1936	535	do	7	−2.06	1.32	37	1.99	6.52	−1.79	1.01	225	1.78	5.90	11.13
L 10	Pollock Rip Slue Lightship (41°36.7′ N.; 69°53.8′ W.).	December 1918-July 1921	720	do	7	−2.92	−0.15	8	1.67	5.60	−3.57	−0.28	197	1.94	6.82	9.77
L 11	Pollock Rip Lightship (41°36.1′ N.; 69°51.1′ W.).	August 1934-August 1935	388	do	7	−2.30	0.68	16	1.25	5.89	−2.66	0.48	202	1.33	6.53	10.55

Values given in this table represent the average observed current.
Additional data for lightships are given in table 13.
For reference to above table, see p. 75.

Table 13.—*Current Data, Nantucket and Vineyard Sounds Lightships, Strengths and Minimums*

[Referred to times of high water and low water at Commonwealth Piers, Boston]

Station no.	Location	Observations		Minimum before flood			Flood strength			Flood duration	Minimum before ebb			Ebb strength			Ebb duration	Mean current hour	Nontidal current	
		Date	Period	Time	True direction	Velocity	Time	True direction	Velocity		Time	True direction	Velocity	Time	True direction	Velocity			True direction	Velocity
			Days	*Hours after low water*	*Degrees*	*Knots*	*Hours after low water*	*Degrees*	*Knots*	*Hours*	*Hours after high water*	*Degrees*	*Knots*	*Hours after high water*	*Degrees*	*Knots*	*Hours*	*Hours*	*Degrees*	*Knots*
L 1	Vineyard Sound Lightship (41°22.8′ N.; 71°00.0′ W.).	September–December 1913.	87	−2.80	266	0.27	0.30	344	0.42	5.82	−3.23	55	0.16	0.07	164	0.55	6.60	10.09	223	0.04
		August 1930–December 1931.[1]	510	−3.70	242	0.17	−0.60	324	0.33	7.12	−2.83	77	0.09	0.17	166	0.32	5.30	9.76	292	0.05
L 2	Hedge Fence Lightship (41°28.3′ N.; 70°29.0′ W.).	Sept. 21–Oct. 19, 1913.	29	0.70	195	0.05	3.91	110	1.23	6.21	0.66	182	0.10	3.57	265	1.17	6.21	1.29	175	0.20
L 8	Great Round Shoal Lightship (41°24.2′ N.; 69°54.9′ W.).	June–September 1911.	87	−0.80	324	0.16	3.10	70	1.35	6.31	−0.74	154	0.57	2.26	244	1.24	6.11	0.04	114	0.10
L 9	Pollock Rip Lightship (41°32.1′ N.; 69°54.8′ W.).	do	87	−2.00	340	0.26	1.10	80	1.32	6.41	−1.84	167	0.80	0.56	210	1.34	6.01	10.96	146	0.38
L 10	Pollock Rip Slue Lightship (41°36.7′ N.; 69°53.8′ W.).	do	87	−2.81	258	0.40	0.20	6	1.41	5.81	−3.25	127	0.42	0.26	205	1.57	6.61	10.10	238	0.25
		June–December 1920.	180	−3.01	290	0.12	0.00	10	1.32	5.91	−3.35	131	0.32	−0.14	205	1.58	6.51	9.88	236	0.18

[1] Velocities from the 1913 series are considered more reliable than those from the 1930–31 series.

Values given in this table represent the average current observed by pole at an average depth of 7 feet.
Additional data for lightships are given in table 12.
For reference to above table, see p. 75.

Table 14.—*Current Data, Edgartown Harbor Vicinity*

[Referred to times of high water and low water at Commonwealth Piers, Boston]

SOUTHERN ENTRANCE OPEN

Station no.	Location	Observations				Slack	Flood strength			Flood duration	Slack	Ebb strength			Ebb duration	Mean current hour
		Date	Period	Method	Depth		Time	True direction	Velocity			Time	True direction	Velocity		
			Days		*Feet*	*Hours after low water*	*Hours after low water*	*Degrees*	*Knots*	*Hours*	*Hours after high water*	*Hours after high water*	*Degrees*	*Knots*	*Hours*	*Hours*
D 7	0.1 mile S. 52° W. of Edgartown Lighthouse (41°23.4′ N., 70°30.3′ W.).	Oct. 1, 1846	½	Float	0	−1.90	0.30	84	1.12	7.43	−0.67	1.78	254	1.12	4.94	11.38
Ma 1	0.2 mile S. 20° E. of Edgartown Lighthouse (41°23.3′ N., 70°30.1′ W.).	Sept. 11-21, 1891	½	Meter	8	−0.70	1.90	88	0.91	5.91	−1.04	0.86	257	0.91	6.51	11.76
Ma 2	0.2 mile S. 10° W. of Snows Point (41°22.4′ N.; 70°30.3′ W.).	Sept. 18-21, 1891	½	Float	0	−1.70	------	325	1.08	6.96	−0.99	1.06	167	1.73	5.46	11.48
		Sept. 14-25, 1891	1	Meter	10	−1.16	1.90	347	1.19	6.54	−0.87	0.66	167	1.84	5.88	11.64
Ma 6	Edgartown Lighthouse (41°23.4′ N.; 70°30.2′ W.)	Aug. 24-Sept. 26, 1891	17	----------	0	−1.72	------	------	------	6.72	−1.25	------	------	------	5.70	11.57
Ma 7	0.2 mile S. 29° W. of Snows Point (41°22.4′ N.; 70°30.4′ W.).	Aug. 30-Sept. 25, 1891	13	----------	0	−1.10	------	------	------	7.36	0.01	------	------	------	5.06	0.09

SOUTHERN ENTRANCE OPEN BUT CONSTRICTED

Station no.	Location	Observations				Slack	Flood									Slack	Ebb strength		
							First strength			Minimum flood			Second strength						
		Date	Period	Method	Depth		Time	True direction	Velocity	Time	True direction	Velocity	Time	True direction	Velocity		Time	True direction	Velocity
			Days		*Feet*	*Hours after low water*	*Hours after low water*	*Degrees*	*Knots*	*Hours after low water*	*Degrees*	*Knots*	*Hours after low water*	*Degrees*	*Knots*	*Hours after high water*	*Hours after high water*	*Degrees*	*Knots*
Ha 1[1]	0.5 mile S. 53° W. of Edgartown Lighthouse (41°23.2′ N.; 70°30.7′ W.).	Nov. 5-6, 1886	1	Pole	5	−1.51	0.02	1	1.31	1.58	359	0.95	2.91	0	1.24	−1.14	0.51	169	2.12

SOUTHERN ENTRANCE CLOSED

Station no.	Location	Observations: Date	Period	Method	Depth
			Days		*Feet*
Mt 1	Midchannel west of Snows Point (41°22.6′ N.; 70°30.4′ W.)	July 13–14, 1871	1	Float	0
			½	Can	4½
			½	do	9
Mt 2	0.1 mile S. 52° W. of Edgartown Lighthouse (41°23.4′ N.; 70°30.3′ W.)	July 15–21, 1871	3	Float	0
			½	Can	3
			½	do	6
Mt 4	0.1 mile S. 5° W. of Edgartown Lighthouse (41°23.4′ N.; 70°30.2′ W.)	Aug. 1, 1871	½	Float	0
H 19	0.3 mile S. 77° E. of Edgartown Church tower (41°23.4′ N.; 70°30.5′ W.)	Sept. 24–27, 1934	3	Pole	7
				Meter	5
				do	13
				do	20

Station no.	Flood: Slack	Flood: First strength: Time	True direction	Velocity	Minimum flood: Time	True direction	Velocity	Second strength: Time	True direction	Velocity	Ebb: Slack	Ebb: First strength: Time	True direction	Velocity	Minimum ebb: Time	True direction	Velocity	Second strength: Time	True direction	Velocity
	Hours after low water	*Hours after low water*	*Degrees*	*Knots*	*Hours after high water*	*Degrees*	*Knot*	*Hours after high water*	*Degrees*	*Knots*	*Hours after high water*	*Hours after high water*	*Degrees*	*Knots*	*Hours after high water*	*Degrees*	*Knots*	*Hours after low water*	*Degrees*	*Knots*
Mt 1	0.90	2.15	162	0.81	−0.54	(292)	−0.10	0.66	213	0.14	1.16	2.33	338	0.47	3.74	348	0.07	−1.30	337	0.83
	0.70	2.10	174	0.95	−1.64	-------	0.00	0.66	162	0.12	1.16	2.36	337	0.59	4.27	-------	0.00	−0.80	342	0.59
	0.75	2.00	190	0.84	−1.44	[2] S.	0.01	0.86	174	0.13	1.06	2.46	348	0.58	4.17	[2] (S.)	−0.01	−0.90	337	0.70
Mt 2	0.80	2.23	293	0.70	−1.57	(89)	−0.10	0.21	284	0.27	1.07	2.28	75	0.55	4.02	78	0.08	−0.67	89	0.53
	0.65	2.15	286	0.77	−1.94	-------	0.00	0.66	254	0.48	1.16	1.96	72	0.70	3.77	-------	0.00	−1.20	72	0.70
	0.65	2.25	264	0.94	−2.04	[2] (E.)	−0.01	0.56	258	0.58	1.16	1.96	78	0.60	3.57	[2] E.	0.01	−1.20	78	0.60
Mt 4	0.60	1.70	258	0.45	−1.74	(71)	−0.35	0.06	299	0.21	0.86	2.16	89	0.51	4.07	112	0.27	−1.10	100	0.35
H 19	0.33	1.74	250	1.18	−1.73	(87)	−0.10	0.15	252	0.71	0.78	1.67	87	0.75	2.92	85	0.16	−1.68	79	0.83
	0.42	1.78	-------	1.10	−1.70	-------	−0.10	0.15	-------	0.65	0.90	1.85	-------	0.59	2.98	-------	0.20	−1.55	-------	0.74
	0.32	1.74	-------	1.06	−1.72	-------	−0.06	0.15	-------	0.63	0.88	1.82	-------	0.81	2.97	-------	0.23	−1.53	-------	0.84
	0.20	1.76	-------	0.99	−1.85	-------	−0.11	0.10	-------	0.55	0.88	1.82	-------	0.78	3.02	-------	0.23	−1.62	-------	0.77

[1] At station Ha 1, the observations show a double flood.

[2] S.=southward; E.=eastward.

For reference to above table, see p. 75.

The current cycle as observed at stations Mt 1, Mt 2, Mt 4, and H 19 generally consists of a double flood and a double ebb. Starting at slack before flood, the westward or southward velocity increases to a maximum which is designated "First strength of flood." It then decreases to a minimum value called "Minimum flood", after which it increases to a second maximum designated "Second strength of flood." Similarly, after slack before ebb the eastward or northward velocity reaches a maximum, a minimum, and a second maximum which are designated, respectively, "First strength of ebb", "Minimum ebb", and "Second strength of ebb."

A minus sign preceding a velocity shows that its direction is opposite that indicated by the heading. The actual direction of such a velocity is enclosed in parentheses.

TABLE 15.—*Current Harmonic Constants, Nantucket Sound Vicinity*

Constituent	Station L 3, Cross Rip Lightship			Station L 4, Handkerchief Lightship			Station L 7, Stone Horse Shoal Lightship			Station L 11, Pollock Rip Lightship		
	Velocity	Epoch		Velocity	Epoch		Velocity	Epoch		Velocity	Epoch	
	H	Local (κ)	Greenwich	*H*	Local (κ)	Greenwich	*H*	Local (κ)	Greenwich	*H*	Local (κ)	Greenwich
	Knots	*Degrees*	*Degrees*	*Knots*	*Degrees*	*Degrees*	*Knots*	*Degrees*	*Degrees*	*Knots*	*Degrees*	*Degrees*
K_1	0.093	19	89	0.057	308	18	0.103	318	28	0.083	222	292
K_2							0.091	209	349			
L_2							0.186	250	30			
M_1							0.007	252	322			
M_2	1.013	237	18	1.202	212	352	1.808	183	323	1.210	168	308
M_3							0.017	15	225			
M_4	0.046	142	63	0.089	140	60	0.079	110	30	0.018	336	255
M_6	0.016	10	72	0.003	103	163	0.034	21	81	0.061	137	196
M_8	0.005	96	298	0.022	60	261	0.012	308	148	0.012	35	234
N_2	0.234	205	346	0.237	171	311	0.286	143	283	0.210	130	270
O_1	0.042	332	42	0.052	342	52	0.072	255	325	0.016	211	281
P_1							0.036	304	14			
Q_1							0.008	271	341			
S_1							0.021	77	147			
S_2	0.183	265	46	0.171	249	29	0.279	216	356	0.180	200	340
μ_2							0.075	346	126			
Observations	Aug. 8–Nov. 2, 1934			Aug. 7–Nov. 1, 1934			Aug. 7, 1934–Aug. 10, 1935			Aug. 7–Nov. 1, 1934.		
Length of series	87 days			87 days			369 days			87 days.		
Method	Pole			Pole			Pole			Pole.		
Average depth	7 feet			7 feet			7 feet			7 feet.		
Direction of flood strength	91° true			80° true			37° true			16° true.		
Direction of ebb strength	272° true			251° true			225° true			202° true.		

Epochs apply to the times of flood strength.
The local epochs refer to the local meridian, Greenwich epochs to the Greenwich meridian.
For reference to above table, see p. 76.

TABLE 16.—*Current Harmonic Constants, Nantucket and Vineyard Sounds and Vicinity, North and East Components*

Constituent	Component	Station L 1, Vineyard Sound Lightship			Station L 8, Great Round Shoal Lightship			Station L 9, Pollock Rip Lightship			Station L 10, Pollock Rip Slue Lightship		
		Velocity	Epoch		Velocity	Epoch		Velocity	Epoch		Velocity	Epoch	
		H	Local (κ)	Greenwich	H	Local (κ)	Greenwich	H	Local (κ)	Greenwich	H	Local (κ)	Greenwich
		Knots	*Degrees*	*Degrees*	*Knots*	*Degrees*	*Degrees*	*Knots*	*Degrees*	*Degrees*	*Knots*	*Degrees*	*Degrees*
K_1	N.				0.003	58	128	0.039	149	219			
	E.				0.101	341	51	0.095	295	5			
M_2	N.	0.449	153	295	0.621	191	331	0.650	135	275	1.446	150	290
	E.	0.169	252	34	1.150	232	12	1.186	191	331	0.500	185	325
M_4	N.	0.034	92	16	0.126	83	3	0.126	225	145	0.149	319	239
	E.	0.029	259	183	0.143	187	107	0.039	17	297	0.091	141	61
M_6	N.				0.021	15	75	0.021	303	2	0.054	147	206
	E.				0.041	306	6	0.032	32	91	0.029	20	79
M_8	N.				0.020	2	201	0.025	96	295			
	E.				0.024	246	85	0.018	44	243			
O_1	N.				0.011	246	316	0.016	69	139			
	E.				0.105	264	334	0.030	226	296			
S_2	N.				0.108	219	359	0.095	164	304			
	E.				0.231	259	39	0.153	216	356			
S_4	N.				0.011	177	97	0.008	354	274			
	E.				0.007	75	355	0.017	313	233			
Observations		Sept. 21–Oct. 19, and Nov. 17–Dec. 15, 1913.			June 20–Sept. 14, 1911			June 20–Sept. 14, 1911			June 19–Sept. 13, 1911.		
Length of series		58 days (two 29-day groups)			87 days			87 days			87 days.		
Method		Pole			Pole			Pole			Pole.		
Average depth		7 feet			7 feet			7 feet			7 feet.		
Directions		Magnetic, variation 13° W			True			Magnetic, variation 14° W			True.		

Epochs apply to the times of maximum flow in a north or east direction.
The local epochs refer to the local meridian, Greenwich epochs to the Greenwich meridian.
For reference to above table, see p. 76.

TABLE 17.—*Lunar Constituents of the Current, Station H 19, Edgartown Harbor, Nantucket Sound*

Constituent	Velocity	Epoch	
	H	Local (κ)	Greenwich
	Knots	*Degrees*	*Degrees*
M_2	0.543	238	321
M_4	0.330	15	181
M_6	0.319	236	124
M_8	0.111	230	201

Pole observations, average depth 7 feet.
3 days of observations, Sept. 24–27, 1934.
Epochs apply to the westward strength of the several constituents.
The local epochs refer to the local meridian, Greenwich epochs to the Greenwich meridian.
For reference to above table, see p. 76.

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