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Department of Commerce and Labor
COAST AND GEODETIC SURVEY

J.C. Mendenhall

Superintendent.

State: *Mass*

DESCRIPTIVE REPORT.

Hydrographic Sheet No 2041

LOCALITY:

Nausucket Shoals

1890
190

CHIEF OF PARTY:

Lieut E. M. Hughes U.S.N.

2041

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Descriptive Report.

Hydrographic Sheet No. 2041

Nantucket Shoals - Mass.

Lieut. E. M. Hughes - U.S.N.
Comd'g.

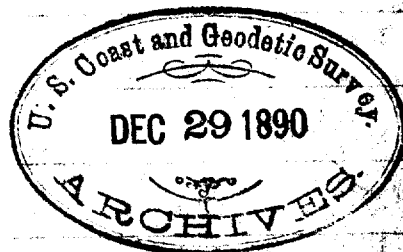
Stmr. "Bache"

Stmr. "Daisy"

Schns. "Screeby" & "Eagre"

ye. ye.

1890



Write me at:

Telegraph me at:

My Express Office:

DEC. 27. 1890. 002631

U. S. Coast and Geodetic Survey,

Navy Yard, New York.

December 20th, 1890.

2-547

Dr. G. C. Mendenhall

Superintendent, C. & G. Survey

Washington, D. C.

Sir:—

In compliance with the requirements of your circular letter of July 3rd, 1890, I have the honor to submit the following report of hydrographic work on Nantucket Shoals, executed during the season just closed by the combined parties of the Steamer Bache and Schooner Eagle, under my command.

General Outlines of Season's Operations.

Joining the Bache at Baltimore, Md., on June 25th, 1890, I at once assumed the active supervision of the extensive repairs then under way, and, on July 15th, relieved Lieutenant J. F. Moser, U.S.N., of the command of the vessel, in compliance

with your instructions of June 16th, 1890.

The work on the *Sache* having been completed and accepted on July 18th, 1890, I on the same day left Baltimore with the vessel, and arrived at Nantucket on August 3rd, the intervening time having been spent in New York and Newport, R.I., awaiting the appropriation by Congress of funds necessary to the prosecution of the Survey. In consequence of this unfortunate delay, nearly a fortnight of what proved to be the finest weather of the season was lost to us.

The hydrographic party of Lieutenant W. P. Elliott, U.S.N., having also been placed under my command for the season's work on Nantucket Shoals, that officer in the Schooner *Eagre*, accompanied by the Steamer *Daisy* and three steam launches, arrived at Nantucket, via New Bedford, on the same day that did the *Sache* — and the Schooner *Scoruby* was towed from New York by the last named vessel. Thus there was assembled off Nantucket on

August 3rd, 1890, the entire plant (for carrying on the seasons work.

The erection and occupation of signals, and preparations for the establishment of tide-gauges was at once begun; sounding was first done on August 8th, and finally discontinued on October 16th, 1890. During the season 2,002 miles of soundings were run, and 54,913 soundings and 11,558 angles taken. The usual table of statistics in detail is appended.

Native field work was closed on October 22nd, in consequence of the extraordinarily bad weather prevalent during that month, the disabling of the Eagle by the loss of her foremast in a gale on September 24th, and the disabling of the Pache through the loss of her tiller, etc., in the severe gale of October 17th.

The Schooner *Scowby* was laid up in winter quarters at Nantucket, with a single shipkeeper on board, and, on October 23rd, the Pache and Eagle left the working ground for New Bedford, en route to New York.

the Daisy, with the steam launches following a day later.

While in New Bedford, the Pache's steering-gear was repaired and put in thorough order.

On October 31st, 1890, the Pache arrived at the New York Navy Yard, where she has since been, completing the office work and preparing the records for transmittal to the Coast and Geodetic Survey Office, and making ready for the winter's work in the Gulf of Mexico.

The Eagle, Daisy and steam launches arrived at the Navy Yard during the first week in November and are now laid up for the winter.

Locality of Survey

Their position and environment rendered difficult the prosecution of a satisfactory hydrographic survey of the shoals lying to the eastward and southward of Nantucket Island. The area to be covered is great, extending far beyond the limit of visibility of the highest objects on shore; the rise and fall of tides

at a given time is unequal in different parts; the currents are strong, and apparently un-
 variable in direction; fogs and hazy weather
 prevail during the greater part of the summer;
 and, finally, there is in the vicinity no safe
 harbor for vessels drawing more than eight
 or nine feet of water.

During the season just closed, but a
 small portion of the entire survey of Pan-
 tucket Shoals was made, and two full seasons
 work probably will be necessary for its com-
 pletion. In view of this fact, an appreciation
 of the newness of the features presented during
 the summer, and a knowledge of the further
 opportunities in store for their fuller examina-
 tion and study, no reference will be made
 in this report to such points as the aspect
 of the coast, landmarks, channel depths, changes,
 etc., nor, except in a general way, or where
 they bear directly on the work done, to tides,
 currents, fogs or winds. It is believed that
 information on these subjects can be submitted
 to the Office in more reliable shape when the
 final report on the survey of the Shoals

is made.

General Description of the Work Done

To the steam launch was assigned that portion of the work just to the eastward of Nantucket island, extending off-shore as far as signals could be seen, (to about $69^{\circ} 50' N.$), and lying between the parallels $41^{\circ} 15'$ and $41^{\circ} 24' N.$ Over this ground North and South lines were run, at a distance apart of one quarter of a mile; these were crossed by East and West lines separated by a like space. Over the prolongation of Bass Rip, the lines were multiplied, being but one eighth of a mile apart. In addition to this system executed by the launch, about eighteen lines were run by the Tache in a general direction N. N. W. and S. S. E.

The development of the usual curves in the space covered by the launch shows that the work is satisfactorily done, save that on the extension of Bass Rip, before referred to, one or two days boat work is still desirable.

In this connection it may be stated that during the next season's work on

on Nantucket Shoals, if it be confined to the limits of projection No. 11. (which will no doubt afford ample work for two vessels for one summer), the large steam launches will not be required, there being no work for them to do within reach of shelter in the event of their encountering heavy weather on short notice.

It was originally intended that the launch parties should establish a camp near the northern extremity of Great Point, using it as a base for their boat ^{work}, but this proved impracticable, owing to the difficulty of caring for the launches at night, and supplying them with fresh water. Nantucket was consequently made the headquarters for the launches, and, considering that they had to steam eighteen miles to and from their working ground, the number of miles of soundings done by them is very creditable.

Directly to the eastward of the area assigned to the launches, the work was extended by the Daisy, which vessel, in charge of L. K. Reynolds, U.S.N., ran N. and E. since

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between the meridians $69^{\circ}50'$ and $69^{\circ}46' N.$ long. — and also a few E. and W. lines, south of the launched work, and on and to the eastward of Bass Rip.

The Daisy is especially valuable as a tender, however, and her probable loss to the survey during next summer will be keenly felt. In the hands of a competent officer, such as was the one last in charge of her, she could do excellent work in the way of pumping down signals, tide-gauges, etc., in water too shoal for vessels like the Bache and Endeavor.

By the Bache's party was executed all work to the southward of parallel $41^{\circ}15' N.$, aggregating 1,037 miles, or a little more than half that accomplished during the season. Over three quarters of this work consists in the development of the nature of the bottom within sight of signals on shore, but it also includes 223 miles of off-shore soundings (six lines) from Nantucket to the vicinity of the $4\frac{1}{2}$ fathom shoal to the Sd. and Wd. of Davis' South Shoal Light-vessel. The

inshore work, extending from that done in the Sack, by Lieutenant Moser in 1889, to Pass Rip, and as far south as parallel 41.09 N., is fully completed, with the exception of one days ship work directly south of Miacomet Rip.

The lines of soundings of both the Sack and the steam launches were carried to within an eighth of a mile of the beach. The intervening space having been fully covered by the boat-work of the shore party under the charge of Mr. H. L. Marindin, Asst. Lt. & Lt. Survey, no effort was made to cover the ground a second time, and for the soundings, etc., necessary to fill in the space in question, recourse must be had to the records of Mr. Marindin's party.

An examination of the progress sheet shows that the work has been full, and the development close, within the limits whose completed. In many places, notably in the funnel-shaped channels between the shore and Old Man Shoal, and between the latter and Pass Rip, the lines are closer than a

proper development demands, and are irregular
 in direction and distance between successive
 positions. This is due to the strong, variable
 currents, encountered at times, to running down
 rips (seeking for the shoalest water), to hazy
 weather, and, mainly, to the ship necessarily
 passing over the same ground frequently, on
 her way to and from work, and the custom
 on board the Tache to sound steadily when-
 ever within the limits of the work, even at
 the expense of duplicating a portion of a line.
 Haze is a factor in the undue multiplication
 of lines, in that, after beginning a day's
 work, it has often obscured the signals,
 and left the choice between losing a fine
 day, and confining operations to a portion
 of the ground already fairly covered. In
 such cases I have invariably continued the
 work, holding that in such lumpy and
 uneven bottom as obtains off the island of
 Nantucket, it is impossible to get too many
 soundings - particularly when within sight
 of landmarks by which a mariner may
 ascertain or verify his position.

Signals.

But four large tripods were erected, as it was found possible to use light houses, church steeples, and prominent objects along shore as signals.

For the off-shore lines, however, floating signals were necessary, and for this purpose use was made of the Schooners Eagle and Scoresby, and Davis South Shoal light-vessel.

After an unsuccessful attempt on August 17th, 1890, the two schooners were on August 25th anchored on the Shoals, nearly on a line from Sankaty Head to Davis South Shoal, the Pache and Daisy at the same time taking such positions to the westward as would complete a system of well conditioned triangles, extending to Davis South Shoal light-vessel. Observers simultaneously occupied triangulation points on shore, and each of the Coast Survey vessels, and the positions of the Eagle, Scoresby and light-vessel were accurately determined.

In consequence of the generally unseasonable

condition of the spars, sails, and ground tackle of the *Scoreby*, her crew was taken off, and she was left securely battened down, riding to a scope of fifty-five fathoms of chain, her starboard anchor backed by the port one.

The *Eagle* being well found in every way, retained her crew on board, and was at all times in condition to slip and seek shelter in case of necessity. During the season she was four times forced from her station by stress of weather, and each time, on her return, took up a somewhat different position; fortunately her station was in sight from shore (distant over ten miles) and she was "cut in" without difficulty.

The results obtained from the use of these floating signals during the past season were unsatisfactory in several respects. The *Scoreby's* cable was light and much worn, and in order to give the schooner a fighting chance for her life, in the heavy heaving seas that surge over the Shoals in bad weather, it was deemed imperatively

necessary, to give her a scope of at least 55 fathoms, and this in itself impaired her usefulness as a signal - The light-vessel was anchored with a still greater scope of chain - and thus, while the positions obtained from these signals are much more reliable than could be any results depending upon a vessel's course and run in such strong and varying currents, yet they are far from being precise, and precision should be sought after in this, as it is in other work prosecuted by the Coast and Geodetic Survey.

As a matter of fact, the off-shore lines slightly, but very noticeably, swerve to the eastward, each time a shore signal is dropped and a floating signal picked up, after which the lines go on in their original direction. Repeated but unavailing efforts, extending over many days, have been made in the draughting-room, to account for this peculiarity. Among other plans, a trial sheet was prepared on which each floating signal was plotted in different

positions in a circle round the anchor, with a radius equal to the scope of chain out, but none of the assumed positions would rectify the crooked lines.

Again, while in the case of the Eagle new "cuts", and in that of the Scoresby repeated bearings of Davis' South Shoal light-vessel and an unchanged depth of water, seem to give assurance that both vessels were in position, yet, being moored with light-weight anchors of the ordinary pattern, there remains an element of doubt as to the possible trustworthiness of their positions which renders their use as signals unsatisfactory.

The absence of the Eagle from her station on two occasions operated to prevent the running of long off-shore lines. The intervals of good weather were short, and, when forced in by a gale of wind, the Eagle could hardly get water and provisions on board and return to her station before another spell of bad weather set in.

As a result of my recent experience

on Nantucket Shoals, I am of the opinion that, in order to be of value as long-distance floating signals, fairly staunch vessels should be employed, (the *Scurvy* and *Drift* would probably answer the purpose during the summer season), with moorings nearly as heavy as those of light-vessels, in order that an extremely short scope of cable may be given, and the signals remain reasonably certain not to drag. Each cable should be fitted with a swivel; vessels anchored on Nantucket Shoals naturally follow the tide round, and almost always swing the same way (i.e., "with the sun") thus rendering the use of a swivel unnecessary to prevent kinking the cable, and possibly starting the anchor.

For the smaller floating signals, it is respectfully submitted that much trouble, delay and expense might be avoided if authority could be obtained to borrow for one or two seasons, twelve first class buoys from the Light House Establishment. These should be accompanied by their moorings,

which should be of the heaviest character (and shortest possible scope, consistent with their being planted in ten fathoms of water and insured against dragging), and should be placed in position by a regular buoy-tender of the Light House Establishment, under the direction of the officer conducting the survey, neither the Sacke nor the Endeavor being suitable vessels for the handling of heavy buoys and their moorings. Six of the signals should be can buoys, and six the longest spar buoys. These signals should be placed in position during the month of May, that actual sounding may begin not later than June 1st, 1891.

Unless the Drift is in a better condition than the Soreby, it will not be safe to keep crews on either of these vessels during the time they are anchored as signals on the Shoals. Last summer the Soreby's position was such that she was well in on the Shoals, clear of all passing vessels, in consequence of which no anchor light was required. If, however, it should be desirable

or necessary during the coming season to anchor a vessel, as a signal, in such a position, that an anchor light should be maintained, then it will be necessary to provide a vessel on which a small crew can be kept. In such a case, it is suggested that a relief light-vessel, if its use could be obtained for the summer months, would answer the purpose exceedingly well, and possess the additional advantage of having heavy ground-tackle. If the Drift and Hersey are to be used as signals, the heavy moorings before referred to, should be provided for them, either by purchase (which would prove very expensive) or by borrowing them from the Light House Board.

Tides

The warping of the surface of the ocean off the Southern and Eastern shores of New-England, supposed to be due to the meeting of the tidal systems of the Gulf of Maine and of the Atlantic near the meridian 70° W. longitude, rendered the operation of reducing the soundings a tedious one.

Observations of the tides were made only for the purpose of obtaining the necessary reductions, and to this end gauges were established at Great Point, and on the southern shore of Nantucket near Tom's River's Head.

Extensive use was made of the readings of a self-registering tide-gauge maintained by a shore party under the charge of Mr. A. L. Marindin, Assistant U. S. Geol. Survey, who most kindly furnished me with a record of such readings as I desired, and in every way exerted himself to supply me with valuable information. The self-registering gauge here referred to was established, first, on the eastern side of Nantucket island (near the Wauwinet Harbor), and, afterward, on the southern shore, near Forked Pond. Care should be taken not to confound the Forked Pond gauge with the box gauge near Tom's River's Head.

The following table indicates the character and approximate position of the tide-gauges used during the past season. A fuller description of each gauge is inserted

in its appropriate book of tidal observations.

Name	Kind	Approximate Position	
Great Point	Plain	Lat. 41° 23' 00" N.	Long. 70° 02' 30" W.
Haulover	Self-registering	" 41° 19' ⁴⁴ 30 "	" 70° 04' 30 ^{69 59 35} "
Tom Kiver's Head	Box	" 41° 14' 30" "	" 69° 58' 30" "
Forked Pond	Self-registering	" 41° 14' 18" "	" 70° 03' 30 ^{03 43} "

Great difficulty was experienced in maintaining the box-gauge near Tom Kiver's Head, three different gauges having been established at this point, each one being demolished by the first gale following its erection. A passable plane of reference was obtained for each gauge, but the bench marks were washed away with the gauges, and before they could be referred to a permanent bench. The temporary benches were set far enough back to be, apparently, out of danger, but the seas destroying the gauges were unusually heavy, and changed the aspect of the entire beach, and the dunes immediately back of the gauges. Steps should be taken before beginning the next season's work, to provide an iron box-gauge, to be securely anchored in a selected position,

which should be about a thousand metres to the eastward of that last occupied.

Derivation of Tidal data. From the Atlantic Tide Tables, U. S. Survey, 1890, were obtained the comparative times of corresponding high waters at Great Point, Siasconett and Neworden — Also, the mean rise and fall at these places.

The comparative time of high water (with reference to Siasconett, Great Point, etc.) and the mean rise and fall at Haulover, were obtained directly from readings of the Haulover self-registering gauge.

The approximate time of high water at the box gauge near Tom Stevens' Head (relative to the corresponding high water at the Haulover gauge) was obtained by taking the difference of time between corresponding high waters on these gauges. The mean rise and fall at the gauge near Tom Stevens' Head was obtained directly from readings of the gauge.

The comparative time of high water (with reference to Haulover, etc.) and the mean rise and fall at Forked Pond gauge, were

obtained directly from readings of these gauges.

The data derived as described above, may be roughly tabulated as follows:—

Time of high water, is later than time of corresponding high water at Howland	Mean rise and fall of tide
At Howland, --- 0 h. 00 m.	2.2 feet
" Forked Pond gauge, 2 h. 00 m.	2.0 " 1.3
" Four Trees " , 3 h. 00 m.	1.3 ? " 2.0
" Siasconnet, --- 3 h. 45 m.	2.3 "
" Haulover gauge, 4 h. 29 m.	3.3 "
" Great Point, --- 4 h. 26 m.	3.2 "

Sub-division of Tidal area. In consequence of the reduction and distortion of the tides in the vicinity of the cardinal line (falling in about the S. E. knuckle of Nantucket island, the ground, covered by the work of the season just closed was, cut up into sections, for convenience in deducing and applying the corrections necessary to reduce the soundings to a common plane of reference. The general direction of the cotidal lines largely determined the limits of these sections, five in number,

as follows, (Reference is to space within the limits of Projection No. 11, covering the lower part of Nantucket Shoals)

Section I. includes all the space to the northward of parallel $41^{\circ} 19' N.$

Section II. includes all the space between parallel $41^{\circ} 19' N.$ and a line (prolonged) drawn from the point of intersection of parallel $41^{\circ} 15' N.$ and the S.E. shore of Nantucket, through the point of intersection of parallel $41^{\circ} 12' N.$ and meridian $69^{\circ} 51' W.$

Section III. includes all the space between the line forming the southern boundary of Sec. II., and a line (prolonged) drawn from the point of intersection of merid. $70^{\circ} 01' W.$ with the south shore of Nantucket, through the point of intersection of parallel $41^{\circ} 10' N.$ and merid. $69^{\circ} 54' W.$

Section IV. includes all the space between the western boundary of Sec. III., and a line (prolonged) drawn from the point of intersection of merid. $70^{\circ} 01' W.$ with the south shore of Nantucket, through the point of intersection of merid. $70^{\circ} 02' W.$

with parallel 41° 10' N.

Section V., includes all the space to the westward of the western boundary of Section IV.

The sketch of the locality of the survey in question shows the position of these sections, and, also, of a special sub-division covering Old Man Shoal, the soundings on which were reduced by data obtained from the readings of the Forked Pond gauge.

For Section I., it is assumed that the mean rise and fall of tide is uniform, and the time of a given stage of the tide, the same for the entire section, both the rise and fall and the time, being that determined by the readings of the Haulover gauge, or some gauge referred to that at Haulover.

For Section II., it is assumed that the time of a given stage of the tide is the same throughout the section, but that the mean rise and fall is variable, decreasing to the southward. The time is assumed to be the same as that shown by the Haulover gauge at a corresponding stage of the tide. The mean rise and fall at intermediate points

and for designated belts in this section, is obtained by interpolation, on the basis of the difference between the heights of corresponding stages at Haulover and Siasconsett, and is as follows:—

At Haulover gauge	3.3 ft.
Parallels #1.19 to #1.18	3.0 " (Use 91% of reduction at Haulover)
" #1.18 to #1.17	2.7 " (" 82% " " ")
" #1.17 to #1.16	2.3 " (" 70% " " ")
At Siasconsett	3.3 " (" 70% " " ")
All south of par. #1.16	1.8 " (" 55% " " ")

For Section III., the range of tide, and the time of a given stage of the tide are assumed to be nearly uniform for the entire section, and are determined directly from readings of the box gauge near Tom Stevens' Head.

For Section IV., the range of tide, (1.8 feet), and the comparative time of a given stage of the tide, (two hours earlier than for a corresponding stage on the box gauge near Tom Stevens' Head) are assumed to be nearly uniform for the Corhole section.

For Section V., the mean rise and fall

of tide, and the relative time of high water are assumed to be nearly uniform, and the same as at New Bedford.

In the reduction of soundings made on Nantucket Shoals during the summer of 1890, they were referred to the following gauges and corresponding planes of reference:

Date	Vessel	Letter	Gauge	Plane of Ref.
Aug. 25	Stamer Bache	A.	Tom Stew's Head	2.00 fms
" 26	" "	B.	do	2.00 "
" 29	" "	C.	Haulover	5.70 "
" 31	" "	D.	do	5.70 "
Sept. 1	" "	E.	do	5.70 "
" 2	" "	F.	do	5.70 "
" 3	" "	G.	Haulover and Tom Stew's Head	9.70 "
" 4	" "	H.	Haulover and Tom Stew's Head	5.70 "
" 5	" "	I.	Haulover and Tom Stew's Head	9.70 "
" 6	" "	J.	Haulover and Tom Stew's Head	5.70 "
" 10	" "	K.	Tom Stew's Head	9.70 "
" 11	" "	L.	Tom Stew's Head	9.70 "
" 19	" "	M.	Haulover	5.70 "
" 20	" "	N.	do	5.70 "
" 22	" "	O.	do	5.70 "
" 23	" "	P.	Forked Pond	2.40 "
Oct. 1	" "	Q.	do do	2.40 "
" 2	" "	R.	do do	2.40 "
" 3	" "	S.	do do	2.40 "
" 6	" "	T.	Great Point	3.12 "
" 9	" "	U.	do do	3.12 "
" 10	" "	V.	Forked Pond	2.40 "
" 16	" "	W.	do do	2.40 "

Notes.— Referring to the preceding table, it should be remarked that on Sept. 30 and Oct. 1, 2, 3, 10 and 16, when Forked Pond gauge was

used, the plus correction was arbitrarily limited to a value not exceeding one foot.

Date	Vessel	Letter	Gauge	Plan of Ref.
Sept 3	Packer's whalerboat	a	Tom Clavers Head	9.70 ft.
Oct 1	do do	b	Forked Pond	2.40 "
" 2	do do	c	do	2.40 "
" 3	do do	d	do	2.40 "
" 1	Packer's gig	A.	do	2.40 "
" 2	do do	B.	do	2.40 "
" 3	do do	C.	do	2.40 "
Aug. 25	Daisy	A.	Tom Clavers Head	2.00 "
" 29	do	B.	Haulover	5.70 "
Sept 2	do	C.	do	5.70 "
" 3	do	D.	do	5.70 "
" 7	do	E.	do	5.70 "
" 10	do	F.	do	5.70 "
" 14	do	G.	do	5.70 "
" 20	do	H.	do	5.70 "
" 26	do	I.	Forked Pond	2.40 "
" 30	do	K.	do	2.40 "
Oct 1	do	L.	do	2.40 "
" 2	do	M.	do	2.40 "
" 16	do	N.	do	2.40 "
Aug 8	Launch No. 13	a	Haulover	5.70 "
" 12	do	b	do	5.70 "
" 15	do	c	do	5.70 "
" 25	do	d	do	5.70 "
" 26	do	e	do	5.70 "
" 29	do	f	do	5.70 "
Sept 2	do	g	do	5.70 "
" 4	do	h	do	5.70 "
" 8	do	i	do	5.70 "
" 9	do	j	do	5.70 "
" 10	do	k	do	5.70 "
" 19	do	m	do	5.70 "
" 20	do	n	do	5.70 "
" 22	do	o	do	5.70 "
" 23	do	p	Tom Clavers Head	9.70 "
" 26	do	q	Forked Pond	2.40 "
" 30	do	r	do	2.40 "
Aug. 8	Launch No. 25	a	Haulover	5.70 "
" 12	do	b	do	5.70 "
" 26	do	c	do	5.70 "
Sept 8	do	d	do	5.70 "

Date	Vessel	Letter	Gauge	Plane of Ref.
Sept. 9	Launch No. 25	e	Haulover	5.70 "
" 10	do	f	do	5.70 "
Oct. 1	do	g	Tucked Pond	2.40 "
" 2	do	h	do	2.40 "
Aug. 14	Launch No. 22	a	Haulover	5.70
" 15	do	b	do	5.70
" 29	do	c	do	5.70
Sept. 7	do	d	do	5.70
" 3	do	e	do	5.70
Oct. 1	do	f	Tucked Pond	2.40

Whenever it was possible to do so, the correction obtained from the readings of the Haulover self-registering gauge were employed in the reduction of soundings, that gauge being most favorably placed with regard to the working ground.

The readings of the Great Point (plain) gauge were employed in reducing soundings taken on two days only - October 6th and 9th - when the plane of reference used (3.13 ft.) was that determined directly from the readings of the gauge. Asst. N. L. Marindin connected the Haulover and Great Point gauges, referring them to a common bench on Great Point Lighthouse. The bench mark consists of an horizontal cut, 2 feet 7 inches from lower right hand corner of lower

Eastern Window, and 2 feet 3 inches above the ground; the cut is shown thus: $\frac{U.S.C.S.}{1890}$.

This bench is 16.73 feet above the zero of the Great Point gauge, (1890), which was fastened to a wreck.

The mean low water at the Haulover self-registering gauge (1890) reading 5.7 feet on staff, corresponds closely to a reading of 4.45 feet (?) on the Great Point tide staff (1890). This comparison, obtained from Mr. Marindin, does not agree well with the mean of the readings of 75 low waters on the Great Point gauge, which is 3.13 feet, a discrepancy of 1.3 feet, as yet unexplained.

Tidal Currents

No special current observations were made during the season, and, with the vessels likely to be engaged on the survey of the Shoals, there probably will be few opportunities for work of this character for a long time to come. Indeed, it would seem that a thorough investigation of the currents in this quarter would demand a vessel for this purpose alone.

The currents encountered were very variable, and at times confusing; for example, at half-flood tide, at 11 a.m. on October 3rd, the current was running strong ebb on the S.W. end of Old Man Shoal - and at 4.30 p.m. of the same day, it was slack water on the middle of Old Man Shoal, and running strong ebb off Tom Kears' Head.

Some experience is required in order to distinguish between certain of the many tide-rips, which appear in all directions, and the more dangerous rips on the crests of shoals; these latter rips are at their worst during the strength of the tide, when the current of water races across the shoal with such velocity that a pulling boat, and, frequently, an ordinary steam launch, cannot prevail against it. At such times it is impossible to work on the crest of the shoal without the greatest danger of swamp-
 ing the boat, and as a consequence very shoal spots can be developed only at slack-water, a feature which will render such part of the work rather tedious. The rip

or overfall, is not directly over the crest of the shoal, but somewhat to one side, where the current tumbles into deeper water - it thus shifts from one side to the other, with the change of the tidal current.

"Specimens of Bottom"

But few of these were obtained. During the next season's work on Nantucket Shoals, a day or two will be devoted to the systematic collection of specimens of bottom, within sight of shore signals - Beyond these limits, specimens will be obtained at frequent intervals while sounding.

Changes

It is yet too early in the survey to record material changes observed - and, where noted, it is uncertain whether apparent changes have actually occurred, or whether they may not be due to former insufficient or imperfect surveys.

The 6 ft bump on Pochick Rip, shown on the charts, does not exist, and the 10 ft spot marked about 3 1/2 miles East from the Mauwinet Harbour, was not found; the

latter may exist, however, and a further search will be made for it.

The progress sheet indicates that a continuation of Bass Rip extends well up, tending to a connection with Great Point Rip - as the Old Man Shoal is connected with the island by Pochick Rip.

Weather

The weather experienced during the season was not so good as was expected, the month of October (in which we hoped to accomplish much work) proving extraordinarily boisterous. August and September afforded fair weather for hydrographic work in ordinary localities, but for work on the Shoals, exceptionally fine weather is required. It is frequently the case in the vicinity of Nantucket, that when the weather is clear the water is too rough for work (the clearest weather coming with N.E. winds) - and when the sea is smooth the atmosphere is so hazy as to obscure signals.

South-westerly weather is usually

preceded by a heavy gale swell on the Shoals, while the sea is usually smooth during the first of a north-easter.

Much fog is said to prevail in May and June.

I would strongly urge the desirability of having the vessels of the Survey on the ground at Nantucket early in June, believing that the best time for hydrographic work lies between June 1st and October 10th, with July and August as the best months. Owing to our late arrival at Nantucket (August 3rd) most of last season was lost to us.

In connection with the subject of the weather, I would again refer to the lack of charters in the vicinity of Nantucket and the necessity that vessels employed on the Survey of these Shoals be supplied with good cables of fair scope, to enable them to ride out the occasional severe summer gales encountered.

Office Note

This was participated in by all the

officers attached to the party. Lieutenant W. L. Burdick was given charge of the practical deduction and application of the correction for reducing soundings - Ensign J. T. Luby acted as draughtsman - Ensign L. C. Bertollette had charge of the progress sheet - Mr. J. L. Dunn (Recorder) acted as an observer during the entire season - and Mr. J. S. Martin (Recorder) took charge of the records, keeping them as nearly as possible up to date.

The plotting of positions near the outer ends of the long lines, where but one or two of the floating signals were in sight, was mainly dependent upon bearings of South Shoal light-vessel, and a judicious 'adjustment' - This being the case, it is suggested that in plotting in the soundings at the Office, those beyond positions absolutely determined, be omitted until after another season's work, when opportunity will be afforded for a comparison with soundings which, it is hoped, may be above suspicion.

Owing to the arrangement by which the work of the Launches was plotted on board the Eagle, that vessel being, separated from the Sacke much of the time, it was impossible for me to properly supervise and control that work. I would therefore strongly recommend that hereafter all records be turned in directly to the Sacke, and that all plotting, etc., be done on board this vessel — and that the combination of several parties for the survey of Nantucket Shoals, be considered (in all but the matters of party accounts, expenditures, etc.,) a single party with headquarters on board the vessel commanded by the officer conducting the survey.

The compass courses and changes of courses noted, in the sounding books are not intended to indicate the actual direction of a line, on account of the unknown and varying set of currents, but rather to indicate change of directions.

Miscellaneous

Standard time (75°) has been used

throughout the work.

The position of Davis' South Shoal light-vessel as determined by triangulation is as follows:— Lat $40^{\circ} 54' 54''$ N.

Long. $69^{\circ} 49' 25''$ W. —

The position as given by the light list is:—

Lat $40^{\circ} 54' (57'')$ N.

Long. $69^{\circ} 49' (26'')$ W. —

It would be interesting to learn by what method the light-house authorities so closely determined the position of this light-ship.

The vessels engaged on the next season's work on Nantucket Shoals should be provided with means for carrying on night signalling. In this connection, it is proposed to prepare a simple code of signals to meet ordinary demands.

During the entire season no vessel was seen on Nantucket Shoals, south of the main channel, save those of the Survey.

The description of trigonometrical points and tidal bench-marks in the vicinity of Nantucket, is retained on

~~4/18/91~~

board the Pache for future use.

With the projections 11 and 13 used during the past season, are also returned duplicate projections (unused) of like number.

All of which is respectfully submitted

Edward West Hughes

Lieut. U.S.N., Asst. C. & G. S.

In charge of Survey of
Nantucket Shoals.

Statistics of Field Work executed by *Lieut. E. M. Hughes, U. S. Navy,*

Date of beginning field work.....

Aug. 5th 1890

Date of closing field work.....

Oct. 22nd 1890

RECONNAISSANCE:

Area of, in square statute miles.....

Lines of intervisibility determined as per sketch submitted.....

Number of points selected for scheme.....

BASE LINES:

Primary, length of.....

Secondary, length of.....

Beach measurements, length of.....

Number of days employed in measurements of base.....

Number of days employed in re-measurements.....

TRIANGULATION:

Area of, in square statute miles.....

Signal poles erected, number of.....

Observing tripods and scaffolds built, number of.....

Observing tripods and scaffolds built, heights of.....

Days occupied in opening and verifying lines of sight, number of.....

Stations occupied for horizontal measures, number of.....

Stations occupied for vertical measures, number of.....

Geographical positions determined, number of.....

Elevations determined trigonometrically, number of.....

GEODESIC LEVELING:

Elevations determined by spirit-leveling of precision, number of.....

Lines of geodesic leveling, length of.....

LATITUDE, LONGITUDE, AND AZIMUTH WORK:

Latitude stations occupied, number of.....

Pairs of stars observed for latitude, number of.....

Average number of observations on a pair.....

Longitude stations, telegraphic, number of.....

Longitude stations, telegraphic, number of nights on which signals were exchanged.....

Longitude stations, chronometric, etc., number of.....

Azimuth stations, number of.....

Number of nights of observations for azimuth.....

Number of stars observed for azimuth.....

GRAVITY DETERMINATIONS:

Number of pendulum stations occupied.....

MAGNETIC WORK:

Stations occupied for observations of the magnetic declination, number of.....

Stations occupied for observations of the magnetic dip, number of.....

Stations occupied for observations of the magnetic intensity, number of.....

TOPOGRAPHY:

Area surveyed in square statute miles.....

Length of general coast-line in statute miles.....

Length of shore-line of rivers in statute miles.....

Length of shore-line of creeks in statute miles.....

Length of shore-line of ponds in statute miles.....

Length of roads in statute miles.....

Topographic sheets finished, number of.....

Topographic sheets, scales of.....

Topographic sheets, limits and localities of:

HYDROGRAPHY:

Area sounded in square geographical miles.....

Number of miles ^{sounded} (~~geographical~~) run while sounding.....

Number of angles measured.....

Number of soundings.....

Number of tidal stations established.....

Number of specimens of bottom preserved.....

Current stations, number of.....

Hydrographic sheets finished, number of.....

Hydrographic sheets, scales of.....

Hydrographic sheets, limits and localities of:

Projection #11 - Sec. 1 - Lower part of Nantucket
 at Parals. South and East of Nantucket Isld.,
 lying between parallels 40° 46' and 41° 28' North,
 and meridians 69° 32' and 70° 10' West.

Area sounded in square geographical miles.....	261.00
Number of miles ^{sounded} (geographical) run while sounding.....	2305.10
Number of angles measured.....	11558
Number of soundings.....	54913
Number of tidal stations established.....	2
Number of specimens of bottom preserved.....	7
Current stations, number of.....	0
Hydrographic sheets finished, number of.....	0
Hydrographic sheets, scales of.....	<u>40,000</u>

*Hydrography: - Proj. No 11; Vicinity of Nantucket Isld, Mass.
Summer, 1890*

Date	Letter	Book	Miles Naut.	Soundings	Angles	Vessel	Observers
Aug. 25	A	1	5.50	67	26	"A.D. Backe"	Lieut. Burdick & Mr. Durrin.
" 26	B	1	52.00	568	197	" " "	and Ensign Luby & Bertolotto.
" 29	C	1	38.50	633	127	" " "	Lieut. Winder & Burdick and Ensign Luby & Bertolotto and Mr. Durrin.
" 31	D	1	39.75	771	178	" " "	do.
Sept. 1	E	2	65.00	937	234	" " "	do.
" 2	F	2	74.00	1257	314	" " "	do.
" 3	G	3	47.50	697	199	" " "	do.
" 4	H	3	72.50	979	209	" " "	Lieut. Burdick, Ensigns Luby, & Bertolotto and Mr. J.H. Durrin.
" 10	I	4	45.75	534	174	" " "	do.
" 11	K	4	78.20	804	182	" " "	do.
" 19	L	4 & 5	73.00	1112	328	" " "	do.
" 20	M	5	23.25	354	92	" " "	do.
" 22	N	5	72.30	870	197	" " "	do.
" 30	O	6	58.00	945	256	" " "	do.
Oct. 1	P	6	52.50	1047	232	" " "	Lieut. Winder & Burdick, & Ensign Luby & Bertolotto and Mr. Durrin.
" 2	Q	7	18.25	321	82	" " "	Lieut. Winder & Burdick, Ensigns Luby & Bertolotto and Mr. Durrin.
" 3	R	7	12.25	176	54	" " "	Lieut. Winder & Burdick, Ensign Bertolotto and Mr. Durrin.
" 6	S	7	43.00	550	156	" " "	Lieut. Winder & Burdick, Ensign Luby & Bertolotto and Mr. Durrin.
" 9	T	7	17.25	297	63	" " "	Lieut. Winder & Burdick, Ensign Bertolotto and Mr. Durrin.
" 10	U	7	36.00	541	126	" " "	do.
" 16	V	8	50.25	859	272	" " "	do.
		21	974.75	14328	3698		
Aug. 25	A	1	5.20	229	34	"Daisy"	Lieut. Reynolds & Ensign Durrell.
" 29	B	1	30.50	1418	78	"	" " " " " "
Sept. 2	C	2	16.50	707	58	"	" " " " " "
" 3	D	2	29.00	1607	172	"	" " " " " "
" 9	E	3	31.20	1322	148	"	" " " " " "
" 10	F	3	9.20	440	30	"	" " " " " "
" 19	G	3	18.50	572	104	"	" " " " " "
" 20	H	4	4.50	118	22	"	" " " " " "
" 26	I	4	33.00	1232	232	"	" " " " " "
" 30	K	4	20.00	527	118	"	" " " " " "
Oct. 1	L	5	45.00	1601	316	"	" " " " " "
" 2	M	5 & 6	38.00	1108	284	"	" " " " " "
" 16	N	6	18.50	815	154	"	" " " " " Ensign E.H. Durrell.
			299.10	11694	1750		

Hydrography: Proj. No. 11 (Cont'd)

Summer 1890.

Date.	Letter.	Book.	Miles. Sounding.	Sounding.	Angles.	Vessel.	Observers.
Aug. 8	a	1	23.60	1020	162	Launch #23	Ensigns Rohrbacher & Brown
" 12	b	1	30.40	950	188	" "	" " " "
" 15	c	1 & 4	26.20	826	144	" "	" Buchanan " "
" 25	d	2	23.50	891	138	" "	" " " Pay, Yeo, Crosby.
" 26	e	2	27.00	832	150	" "	" " " Brown.
" 29	f	2 & 3	29.00	922	194	" "	" Rohrbacher " Pay, Yeo, Crosby.
Sept. 2	g	3	9.00	425	76	" "	" " " " " "
" 4	h	3	26.00	920	202	" "	" " " " " "
" 8	i	3	19.00	727	120	" "	" " " " " "
" 9	k	4	32.75	1150	248	" "	" " " " " "
" 10	l	4	22.50	838	164	" "	" " " " " "
" 19	m	5	18.30	519	156	" "	" Buchanan " Brown.
" 20	n	5	18.00	710	156	" "	" " " " " "
" 22	o	5	25.70	941	296	" "	" " " " " "
" 23	p	6	6.50	228	72	" "	" " " " " "
" 26	q	6	22.30	841	220	" "	" " " " " "
" 30	r	6	19.00	674	208	" "	" " " " " "
		17	378.75	13414	2894		
Aug. 8	a	1	30.00	1393	180	Launch #25	Ensign Buchanan & Mr. A. R. Hassan
" 12	b	1	20.00	613	104	" "	" " " " " "
" 26	c	2	31.00	1067	188	" "	" Rohrbacher " Pay, Yeo, Crosby.
Sept. 8	d	3	23.00	849	162	" "	Ensigns Buchanan " Brown.
" 9	e	3	21.00	884	188	" "	" " " " " "
" 10	f	3	11.00	418	90	" "	" " " " " "
Oct. 1	g	4	17.00	580	210	" "	" " " " " "
" 2	h	4	15.00	666	200	" "	" " " " " "
		8	168.00	6470	1322		
Aug. 14	a	1	25.00	1132	138	Launch #22	Ensigns Buchanan & Brown.
" 15	b	1	27.00	760	134	" "	" Rohrbacher & Pay, Yeo, Crosby.
" 29	c	2	28.00	1085	186	" "	" Buchanan & Brown.
Sept. 2	d	3	11.00	622	92	" "	" " " " " "
" 3	e	3	8.50	408	78	" "	" " " " Pay, Yeo, Crosby.
Oct. 1	f	3	19.00	750	190	" "	" Rohrbacher " Durrell.
		6	118.50	4757	818		
Oct. 1	A	1	7.80	543	164	Gig	Lieut. Winder & Mr. J. L. Dunn.
" 2	B	1	13.50	870	200	"	" " " " " "
" 3	C	1	8.00	571	150	"	" " " " " "
		3	29.30	1984	514		
Sept. 3	a	1	1.25	75	22	Whale boat	Lieut. Burdick & Ens. Berfolette.
Oct. 1	b	1	7.60	523	98	" "	" " " " " "
" 2	c	1	13.00	818	230	" "	" " " " " "
" 3	d	1 & 2	11.40	850	212	" "	" " " " " "
			33.25	2266	562		

Hydrography: Proj. No 11 (Contd), Summer, 1890.

Recapitulation.			
Vessel.	Naut. Miles.	Soundings.	Angles.
"A. D. Bache"	974.75	14328	3698
"Daisy"	299.10	11694	1750
Sz. Launch No 23	378.75	13414	2894
" " " 25	168.00	6470	1322
" " " 22	118.50	4757	818
"Bache's" Gig	29.30	1984	514
" Whale boat.	33.25	2266	562
Total on Sheet	2001.65	54913	11558

Signals - 1890

Erected	Occupied	Determined.
5	23	22

Number of days on Station and how employed,
1890

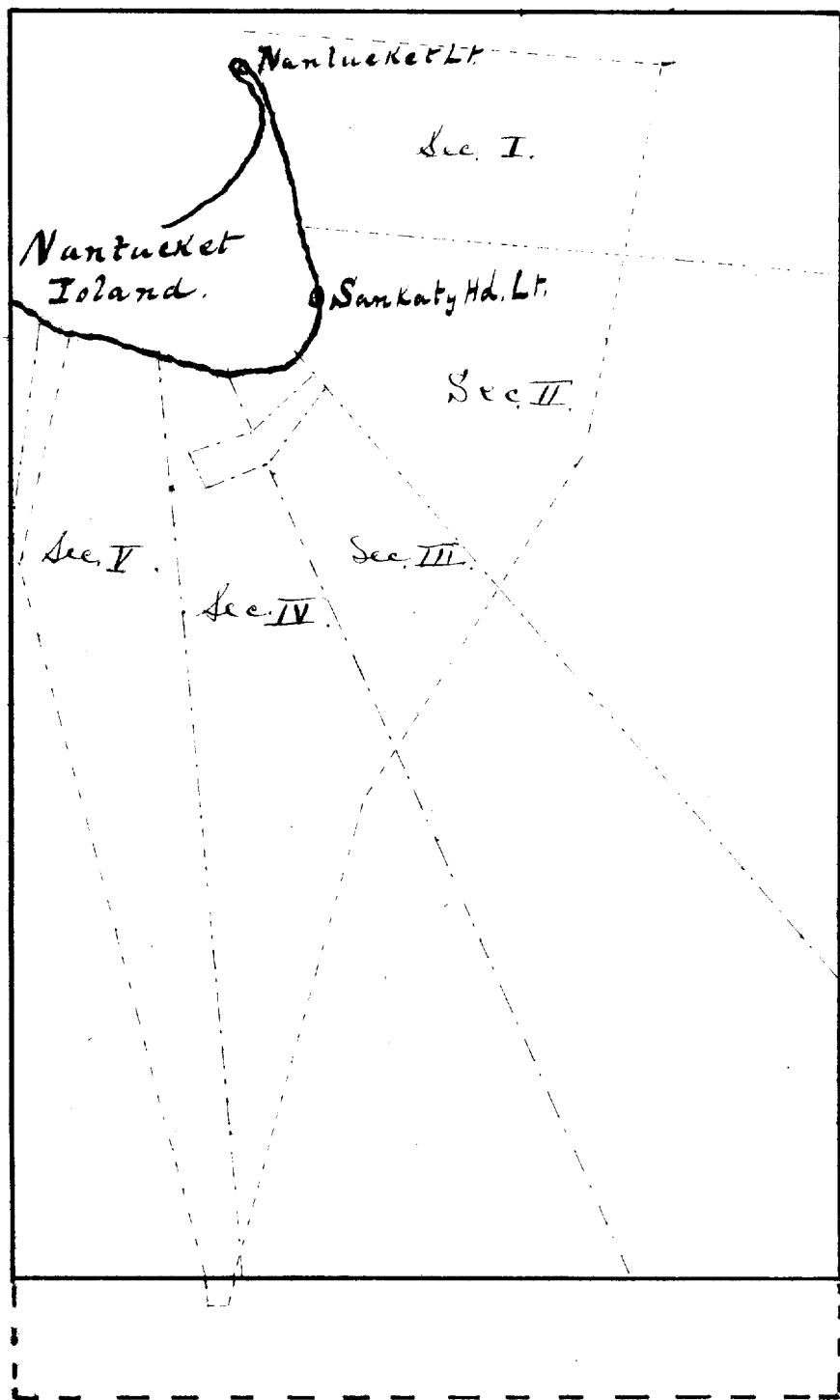
Number of days on Station	79
" " " " which hydro. work was done	29
" " " " " signals were built &c.	5
" " " " " hydro. work was prevented by bad weather & causes	39
" " " " " " " " " " " other	6

Number of Officers and Men in Parties engaged on
Survey of Nantucket Shoals, 1890,

Lieut. Edward M. Hughes, U. S. Navy, in Charge.

Complement.	Vessels.			Total
	Str. "A. D. Bache", Lieut. E. M. Hughes, U. S. N., Command'g.	Sch'r "Eagle", Lieut. W. P. Elliott, U. S. N., Command'g.	Str. "Daisy", Lieut. L. K. Reynolds, U. S. N., Command'g.	
Lieutenants,	2	1		3
" Junior	1		1	2
Ensigns	2	3	1	6
P. A. Surgeon	1			1
Ass't Engineer	1			1
Master-at-arms	1			1
Paymaster's Yeomen	1	1	1	3
Machinists	4	2	2	8
Ship's Writers	1	1		2
Carpenter's Mates	1	1	1	3
Boatswains "	1			1
Quartermasters	4	3	1	8
Ship's Cook	1			1
Cabin Stewards	1	1	1	3
" Cooks	1	1	1	3
Second C. Firemen	4	1	2	7
Seamen	15	10	5	30
Ianasmen	3	2		5
Grand Aggregate	45	27	16	88

Hydrography off Nantucket Island,
Season of 1890.



Hydrographic Sheet No. 11.