

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SURVEY

DESCRIPTIVE REPORT

Type of Survey: Navigable Area

Registry Number: H12640

LOCALITY

State: USVI

Sub-locality: Southwest Shoal, St Croix

2014

CHIEF OF PARTY
Timothy Battista

LIBRARY & ARCHIVES

DATE: April 2014

HYDROGRAPHIC TITLE SHEET

INSTRUCTIONS: The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.

State: **USVI**

General Locality: **Caribbean Sea**

Sub-Locality: **Southwest Shoal, St. Croix**

Scale: **1:10,000** Date of Survey: **March 12 to April 2, 2014**

Instructions Dated: **21 February 2014** Project Number: **M-I907-NF-14**

Vessel: **NOAA Ship *Nancy Foster***

Chief of Party: **Timothy Battista**

Surveyed by: **CCMA Biogeography Branch**

Soundings by: **Reson 7125 SV2**

Graphic record scaled by: **N/A**

Graphic record checked by: **N/A**

Protracted by: **N/A**

Automated Plot: **N/A**

Verification by:

Soundings in: **Meters at MLLW**

Remarks:

- 1) All Times are in UTC.
- 2) This is a Coral Reef Mapping Project and Hydrographic Survey.

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ACRONYMS AND ABBREVIATIONS

AtoN	Aid to Navigation
CUBE	Combined Uncertainty and Bathymetry Estimator
DAPR	Data Acquisition and Processing Report
DGPS	Differential Global Positioning System
DN	Day Number
DtoN	Danger to Navigation
GPS	Global Positioning System
HIPS	Hydrographic Information Processing System
HSSD	Hydrographic Surveys Specifications and Deliverables
IHO	International Hydrographic Organization
MBES	Multibeam
MLLW	Mean Lower Low Water
NAD83	North American Datum of 1983
QC	Quality Control
RNC	Raster Navigational Chart
SSS	Side Scan Sonar
TPU	Total Propagated Uncertainty
UTM	Universal Transverse Mercator
ENC	Electronic Navigation Chart
RNC	Raster Navigation Chart

Descriptive Report to Accompany Hydrographic Survey H12640

Project M-I907-NF-14

Locality: Caribbean Sea

Sub-locality: Southwest Shoal, St. Croix, USVI

Scale 1:10,000

March 2014 – April 2014

NOAA Ship Nancy Foster

Chief Scientist: Tim Battista

Lead Hydrographer: Mike Stecher

A. AREA SURVEYED

The Center for Coastal Monitoring and Assessment (CCMA) conducted hydrographic survey operations in the Caribbean Sea, Southwest Shoal, St Croix, US Virgin Islands. Survey H12640 was conducted in accordance with the Hydrographic Survey Project Instructions (February 21, 2014) for M-I907-NF-14.

A1. SURVEY LIMITS

The extents of the H12640 survey limits are listed in Table 1.

Table 1. H12640 Survey Limits

Northeast Limit	Southwest Limit
17.65 N	17.65 N
64.84 W	64.93 W

A2. SURVEY PURPOSE

The project is being conducted in support of the National Center for Coastal Ocean Science (NCCOS) to provide shallow water bathymetric data of critical benthic habitats in selected areas off of the coast of St. Croix, USVI. Bathymetric data from the project was collected with multibeam echosounder and will further be utilized by the Office of Coast Survey (OCS) to update the nautical charts in the surveyed area.

A3. SURVEY QUALITY

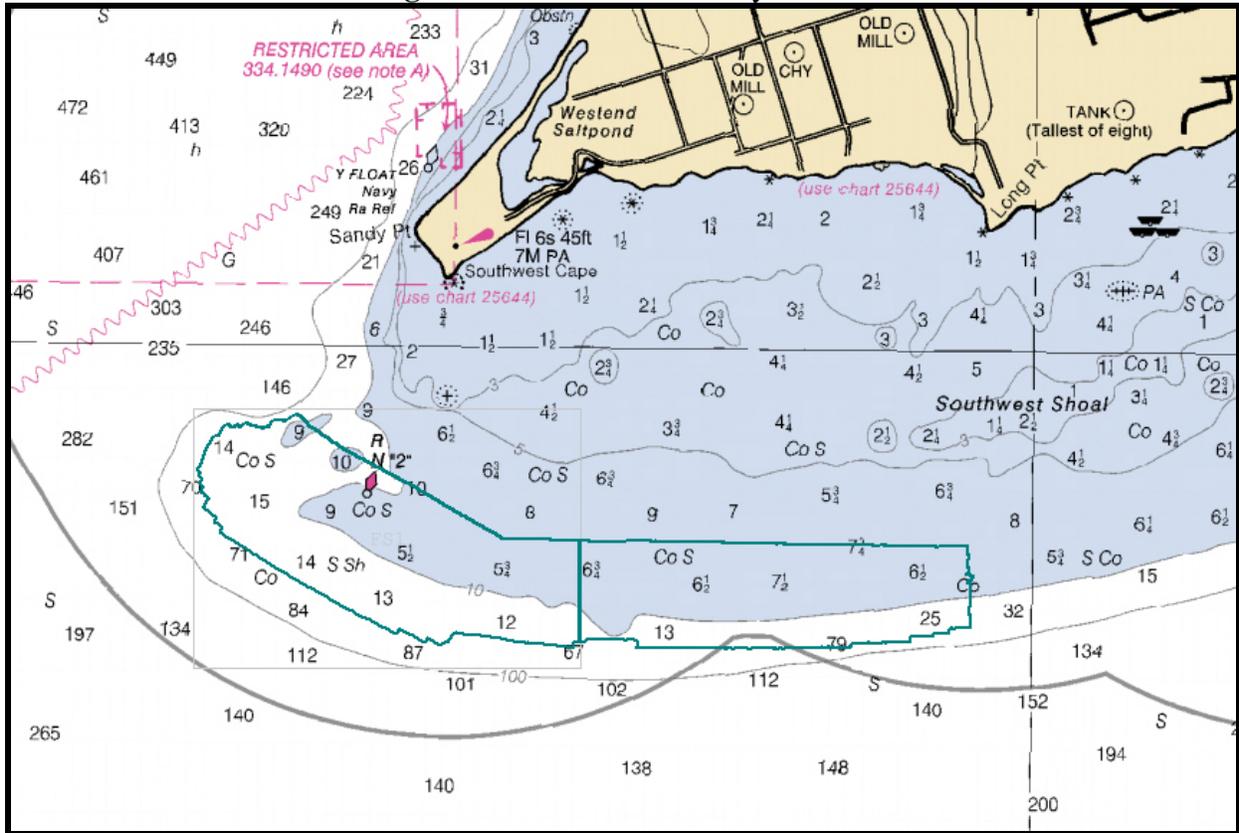
The entire survey is adequate to supersede previous surveys.

A4. SURVEY COVERAGE

As per the Project Instructions, this survey was conducted using the complete coverage multibeam specification as defined in the Hydrographic Survey Specifications and Deliverables April 2014 (HSSD). While conducting the survey, bathymetric coverage was monitored by creating CUBE surfaces with 1-meter, 2-meter, 4-meter and 8-meter resolutions as per HSSD. Sounding densities generally meet the five soundings per node criteria, except in areas where multibeam data were shadowed by features of significant height and from ping drop outs from the Reson 7125-SV2. A fill plan was created for all holidays greater than the required

specifications. Due to a balance between coverage and time allotment some minor holidays do exist in between survey transects.

Figure 1. H12640 Survey Outline



A5. SURVEY STATISTICS

Detailed survey statistics for H12640 are provided in Table 2.

Table 2. H12640 Hydrographic Survey Statistics

Survey Statistics	MBES
MBES main scheme (nm)	141.6
Crosslines (MBES nm)	5.6
Additional full coverage MBES (nm)	0
Additional full coverage MBES crosslines (nm)	0
Number of item investigations that required additional survey effort	0
Number of bottom samples	0
Total number of square nautical miles	4.4

Data acquisition was conducted from March 12, 2014 (DN 071) to April 2, 2014 (DN 092). Table 3 lists specific dates of survey and patch test data acquisition. Patch test data was used to determine system biases in support of the survey are also included with the digital deliverable.

Table 3. H12640 Days of Acquisition

Dates of Acquisition	
March	12-15, 21-23, 25-30
April	2
Dates of Patch Test Acquisition	
March	21

A6. SHORELINE

Shoreline investigation was not required for M-I907-NF-14.

A7. BOTTOM SAMPLES

Bottom Samples were not required for M-I907-NF-14.

B. DATA ACQUISITION AND PROCESSING

B1. EQUIPMENT AND VESSELS

The M-I907-NF-14 *Data Acquisition and Processing Report* (DAPR) submitted under separate cover, details equipment and vessel information as well as data acquisition and processing procedures used during this survey. There were no vessel or equipment configurations used during data acquisition that deviated from those described in the DAPR.

B1.a Vessels

The vessel used during this survey is listed in Table 4.

Table 4. Vessel Specifications

NOAA Ship Nancy Foster	
	
Hull Number	R352
Builder	McDermott, Inc
Year Built	1990
Weight	1190 long tons
Length Overall	187'
Beam	40'
Draft, Maximum	11.2'
Cruising Speed	10.5 knots
Max Survey Speed	7 knots

B1.b Equipment

Equipment systems used during data acquisition are listed in Table 5.

Table 5. Equipment Used

Type	Manufacturer	Model
Multibeam Echosounder	Reson	7125-SV2
Surface Sound Speed	Reson	SVP-71
Primary Sound Speed Profiler	Sippican	XBT Deep Blue
Secondary Sound Speed Profiler	Sea-Bird	SEACAT SBE-19Plus CTD Profiler
Positioning & Attitude	Applanix	POS/MV 320 v4
Positioning & Attitude	Trimble	DSM132

B2. QUALITY CONTROL

Survey data show decent internal consistency. As shown in Appendix II of the DAPR, the lead line check difference was 0.10 meters. Results from the crossline analysis, final CUBE surface uncertainties and the Total Vertical Uncertainties (TVU QC) indicate decent internal consistency of the multibeam data.

B2.a Crosslines

A total of 5.6 nautical miles of crosslines, or 3.9% of all main scheme survey lines, were run for analysis of survey accuracy. Due to time constraints the required total of 5% of main scheme was not met. Crosslines were run in a direction of less than 45 degrees to main scheme lines across most of the surveyed area, providing a good representation for analysis of consistency. All crosslines were used for crossline comparisons.

Crossline analysis was performed using the CARIS Hydrographic Information Processing System (HIPS) Quality Control (QC) Report tool, which compares crossline data to a gridded surface and reports results by beam number. Crosslines were compared to a 2-meter CUBE surface encompassing mainscheme data for the entire survey area. The QC Report plots and tabular data are included in Separate II Digital Data. The results of the analysis meet the requirements as stated in the 2014 Hydrographic Surveys Specifications and Deliverables (HSSD).

B2.b Uncertainty

Survey specific uncertainty parameters for tide and sound speed are included in Table 6. Additional discussion of these parameters is included in the M-I907-NF-14 DAPR.

Table 6. TPU Values for Tide and Sound Speed

Total Propagated Uncertainty Computation in CARIS HIPS*		
<i>Tide Values</i>	Uncertainty* (m)	Day Number Range
Tide Value Measured	0.025	all
Tide Value Zoning	0.05	all
<i>Sound Speed Values</i>	Uncertainty* (m/s)	
Sound Speed Measured (SN 5510)	4.0	all
Surface Sound Speed	0.500	all

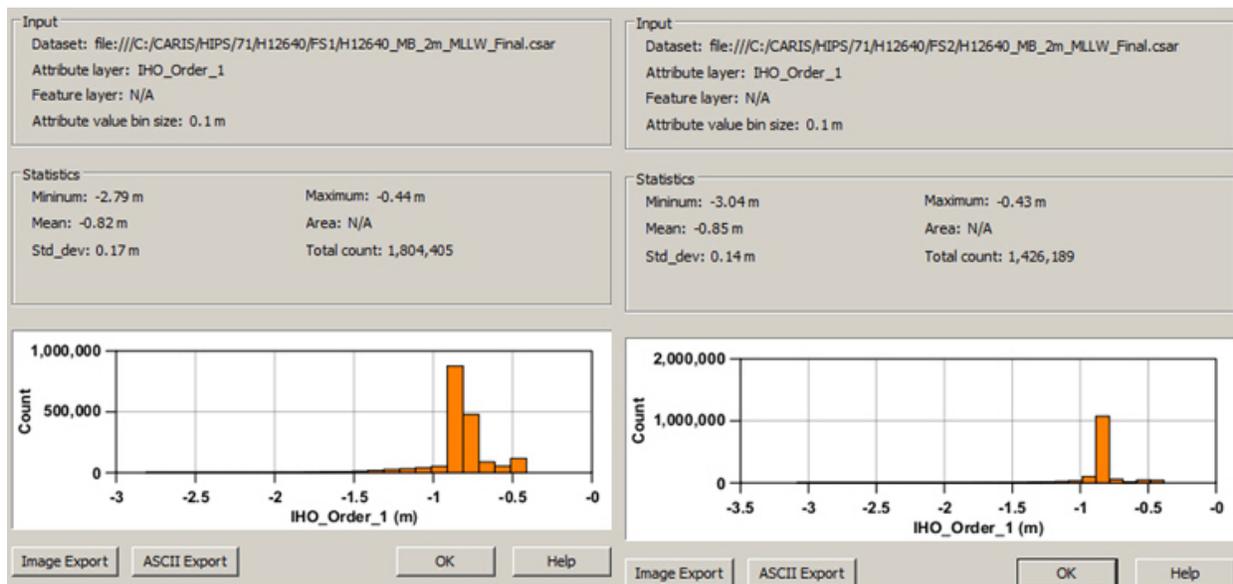
During surface finalization in HIPS, the "greater of the two" option was selected, where the calculated uncertainty from total propagated uncertainty (TPU) is compared to the standard deviation (StdDev) of the soundings influencing the node, and where the greater value is assigned as the final uncertainty of the node. The uncertainty of the finalized surface increased for nodes where the StdDev of the node was greater than the total propagated uncertainty. The resulting calculated uncertainty values of all nodes in the 2m finalized surfaces range from 0.45 meters to 3.34 meters with the larger values resulting from the steep drop offs along the reef shelf or along coral heads. The maximum uncertainty value is associated with a high standard deviation in the depth surface caused by gridding data over an irregular seafloor.

To determine if surface grid nodes met International Hydrographic Organization (IHO) Order 1 specifications a Total Vertical Uncertainty Quality Check (TVU QC) was performed. This routine is used to identify nodes in the 2m finalized CUBE surfaces that have estimated uncertainties that exceed the NOAA specifications. The NOAA uncertainty standards are based on IHO S-44 standards for hydrographic surveys. Specifically, the TVU QC layer compares the estimated uncertainty of the depth estimate to the allowable uncertainty of the depth estimate node by node.

This routine uses the ratio method which visualizes the ratio of the uncertainty at a node to the maximum allowed IHO uncertainty for each node via a computed layer in CARIS. The TVU QC layer scales with depth and demonstrates what fraction of the total allowable error budget is consumed by the estimated uncertainty. The TVU QC layers are labeled as IHO_Order_1 and reside as child layers within the finalized 2m CUBE surfaces for FS1 and FS2 (fieldsheet). The TVU QC layers were reviewed with filters set to -1 to -100, and areas that had these values were further examined by the MBE data processor.

As shown in Table 7, the results from the TVU QC method show that both fieldsheets have met and exceeded IHO Order 1 specifications.

Figure 2. TVU QC Histograms for both FS1 and FS2 Fieldsheets



B2.c Junctions

No Junctioning surveys were provided for this project.

B2.d Sonar QC Checks

Sonar System quality control checks were conducted as detailed in the quality control section of the M-I907-NF-14 DAPR.

B2.e Equipment Effectiveness

The Nancy Foster's Reson 7125-SV2 system has historically had issues with dropped pings, system crashes and issues that seem to reflect sound velocity and/or positioning issues. All resources have been consulted about these continuing issues including Reson, Applanix, HSTP, Chief Survey Tech, Chief Electronic Tech and others to no avail. Although the system does collect data to IHO specification it should be noted that there are areas of lower confidence due to poor system performance.

B2.f Factors Affecting Soundings

No other factors affected the sounding data.

B2.g Sound Speed Methods

Hand launched Sippican XBT's was the primary sound velocity acquisition device. The XBT's were deployed at no more than 5 hour increments during survey while underway and actions were taken to try and distribute the casts evenly throughout the survey area. Occasional SVP casts were performed with an SBE19Plus for comparison purposes (DN71 and DN085). Additional discussion of sound speed methods can be found in the M-I907-NF-14 DAPR.

B2.h Coverage Equipment and Methods

All equipment and survey methods were used as detailed in the M-I907-NF-14 DAPR.

Survey speeds were maintained to meet or exceed along track coverage requirements throughout the survey. A fill plan was created for all holidays greater than the required specifications. Due to a balance between coverage and time allotment some minor holidays do exist in between survey transects.

B3. ECHO SOUNDING CORRECTIONS

B3.a Corrections to Echo Soundings

All data reduction procedures conform to those detailed in the M-I907-NF-14 DAPR.

B3.b Calibrations

No additional calibration tests were conducted beyond those discussed in the M-I907-NF-14 DAPR.

B4. BACKSCATTER

Multibeam backscatter was logged in Hypack .7K format and was processed and evaluated with a combination of Fledermaus FMGT and the Hypack implementation of Geocoder. The backscatter data was used in combination with the bathymetry to create Principal Component Analysis surfaces in GIS to delineate areas of change. This information were used to plan ROV transects to characterize benthic habitats in the surveyed regions.

B5. DATA PROCESSING

B5.a Software Updates

There was a combination of Caris HIPs 7.1.2 and 8.1.8. used to convert and process the data for this sheet. The *Nancy Foster's* main processing machine had both versions loaded. The majority of the data was pre-processed with 7.1.2 and all final data and analysis was performed with 8.1.8.

B5.b Surfaces

Bathymetric grids were created relative to Mean Lower Low Water (MLLW) in CUBE format using complete coverage resolution requirements as described in the HSSD and using the CUBEParams_NOAA.xml file. The survey area was split into two fieldsheets, FS1 and FS2 with identically named CUBE surfaces. BAGs were exported from Caris with the identical name as the surface from which they were derived from.

Finalized CUBE surfaces are delivered with and without depth thresholds. Cube surfaces appended with "Final" are not depth thresholded. Depth thresholds were applied as defined in the HSSD and are appended with the "Depth_TH" description in the file name. The NCCOS and CCMA groups prefer not to have depth thresholded surfaces for seafloor classification reasons.

Thorough analysis determined that the 1m resolution CUBE surface is an accurate representation of the seafloor in the shallow regions and the surface honors the shoalest reliable soundings within 1/2 of the allowable TVU, therefore no designated sounding were used on this survey sheet. Table 7 lists the finalized CUBE surfaces submitted with this survey.

Table 7. H12640 Multibeam Surfaces (FS1 and FS2)

Surface Name	Resolution
H12640_MB_1m_MLLW_Final (Depth_TH)	1.0m
H12640_MB_2m_MLLW_Final (Depth_TH)	2.0m
H12640_MB_4m_MLLW_Final (Depth_TH)	4.0m
H12640_MB_8m_MLLW_Final (Depth_TH)	8.0m

C. VERTICAL AND HORIZONTAL CONTROL

No HorCon or VertCon operations were performed for this survey. A summary of horizontal and vertical control for this survey follows.

C1. VERTICAL CONTROL

The vertical datum for this project is MLLW. Additional information related to tides and tide correctors is included in Tables 9, 10 and 11.

Table 8. Tide Stations

Station Name	Station ID
Christiansted, USVI	9751364
Lime tree Bay	9751401

Table 9. HIPS Water Level Files

File Name	Status
9751364.tid	Verified

Table 10. HIPS Zoning Files

File Name	Status
I907NF2014CORP.zdf	Final Zoning

C2. HORIZONTAL CONTROL

The horizontal datum for this project is North American Datum of 1983 (NAD83) projected in Universal Transverse Mercator (UTM) Zone 20. All of the real-time navigation data were collected in Differential GPS (DGPS) mode. DGPS corrections were received from the U.S. Coast Guard (USCG) beacon located at Isabel, Puerto Rico (295 kHz) or from Omnistar when the vessel was out of range of the Isabel station.

D. RESULTS AND RECOMMENDATIONS

D1. CHART COMPARISON

The chart comparison was performed by comparing a H12640 shoal biased selected sounding layer generated in Caris to the affected RNC and ENC charts listed in the Project Instructions. A 40-meter selected sounding surface of the entire survey area was generated from the finalized 2-meter CUBE depth surface. The chart comparison was conducted by visually reviewing the resultant surface and charted soundings.

D1.a Raster Charts

The raster chart comparison was performed by comparing the RNCs covering the survey area to H12640 using visual comparison techniques. The RNCs are listed in Table 11.

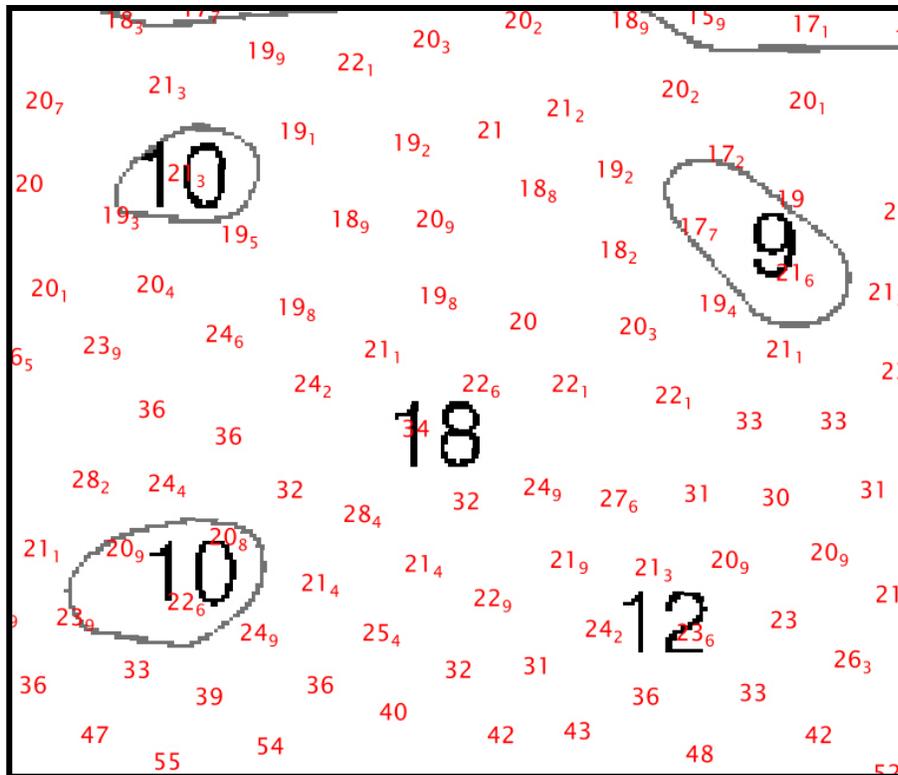
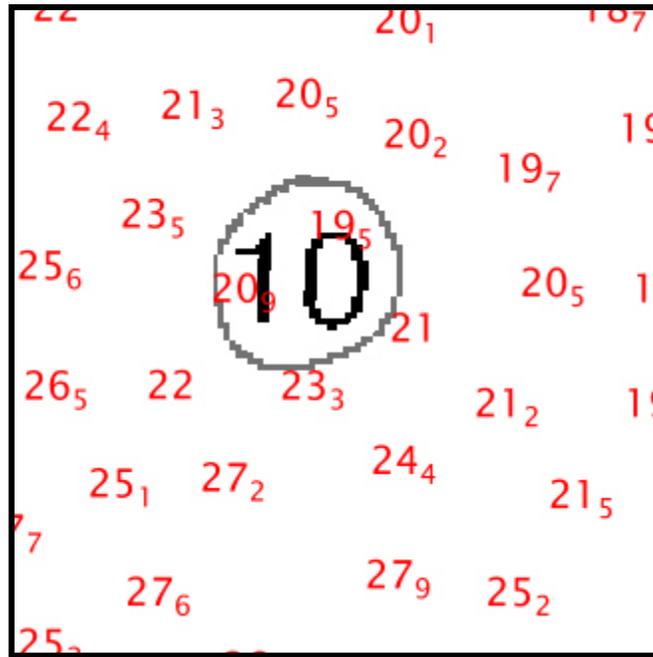
Table 11. RNCs Compared to H12640

Chart	Scale	Edition Number	Edition Date	LNM Date	NM Date
25644	1:20,000	15	01/2014	12/31/2013	01/04/2014
25641	1:100,000	29	09/2013	09/24/2013	09/28/2013
25640	1:326856	45	01/2013	01/21/2014	01/25/2014

25644

Surveyed soundings generally compare to within a few meters with the exception of a several areas where previously surveyed soundings appear to be shoaler. Figure 3 provides examples of multiple discrepancies where RNC soundings were shoaler or mis-charted than the current surveyed soundings.

Figure 3. Sounding discrepancies between H12640 and 25644

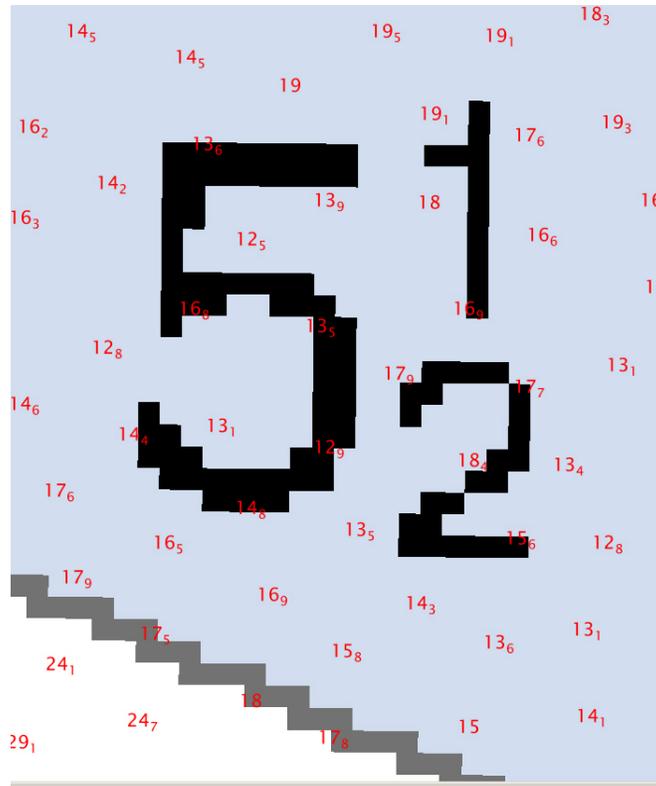


Red soundings from the current survey in meters, charted soundings are in fathoms

25641

Surveyed soundings generally compare to within a few meters with the exception of a several areas where previously surveyed soundings appear to be shoaler. Figure 4 provides an example of a discrepancy where RNC soundings were shoaler or mis-charted than the current surveyed soundings.

Figure 4. Sounding discrepancies between H12640 and 25641



Red soundings from the current survey in meters, charted soundings are in fathoms

25640

Due to the difference of chart scale only a general agreement was observed when comparing RNC 25640 with survey H12640.

D1.b Electronic Navigational Charts

Table 12 lists the ENC's compared to H12640.

Table 12. ENC's compared to H12640

ENC Name	Scale	Edition Number	Update Application Date	Issue Date
US5PR13M	1:20,000	8	09/16/2013	09/16/2013
US4PR11M	1:100,000	74	11/20/2012	08/23/2013
US3PR10M	1:326,856	114	05/06/2013	12/16/2013

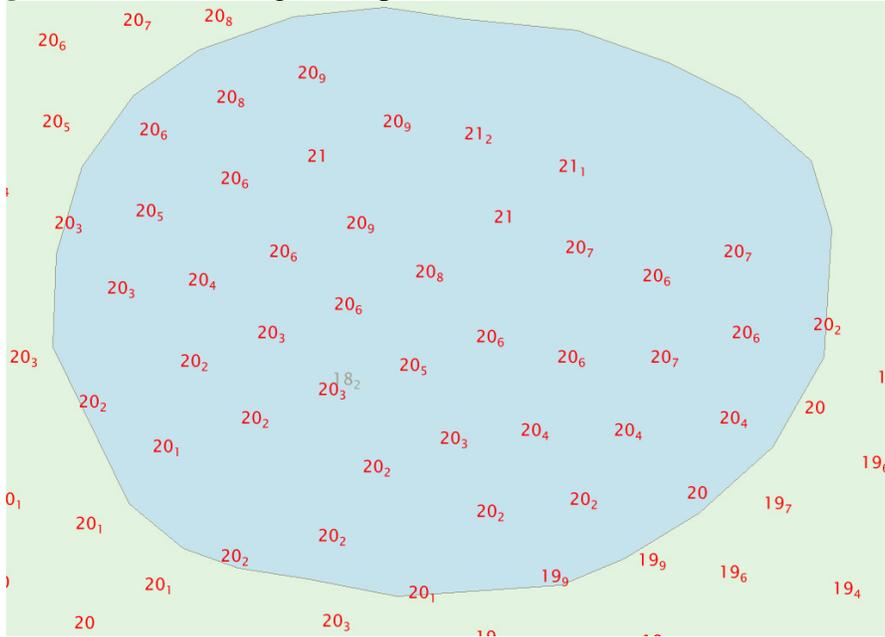
US3PR10M

Due to the difference of chart scale only a general agreement was observed when comparing ENC US3PR10M with survey H12640.

US4PR11M

Surveyed soundings generally compare to within a few meters, Figure 5 provides an example of a discrepancy where ENC soundings were shoaler than the current surveyed soundings.

Figure 5. Sounding Discrepancies between H12640 and US4PR11M

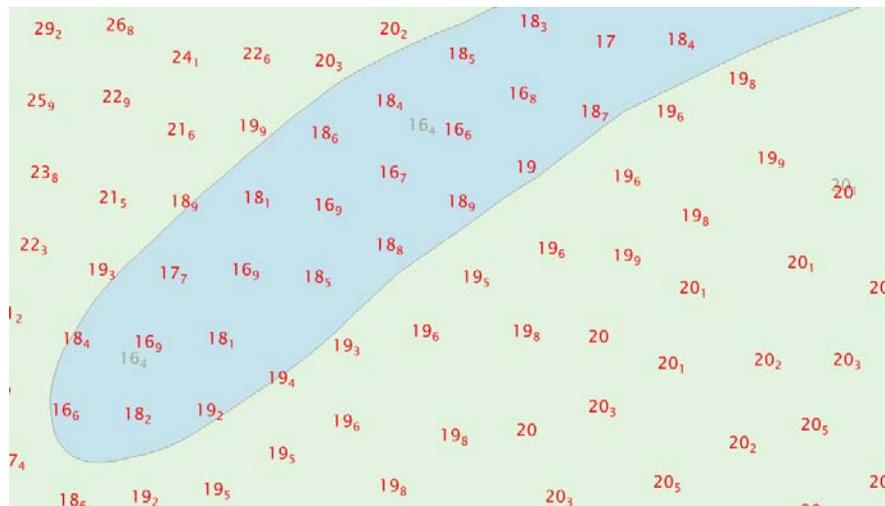


Red soundings from the current survey in meters, charted soundings are in meters

US5PR13M

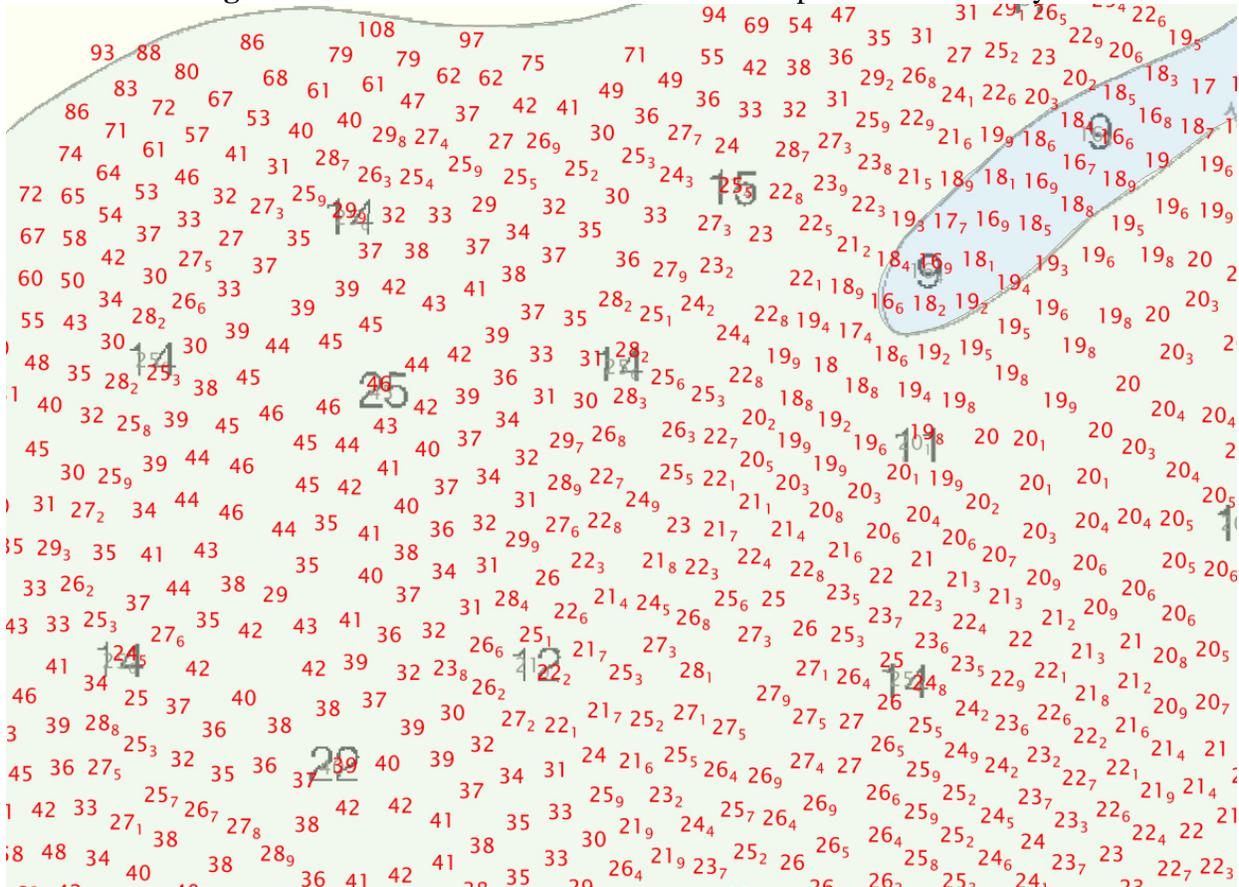
Surveyed soundings generally compare to within a few meters, Figure 6 provides an example of an area where ENC soundings are generally in agreement with the current surveyed soundings.

Figure 6. Sounding agreement between H12640 and US5PR13M



An ENC to RNC comparison reveals that the same sounding information was used to derive both types of charts and the inconsistencies noted previously are also evident in both charts as shown in Figure 7.

Figure 7. 25644 to US5PR13M chart comparison and overlay



Red soundings from the current survey in meters, ENC soundings are in meters, RNC in Fathoms

D1.c AWOIS Items

There were no AWOIS investigations required for this project.

D1.d Charted Features

No charted features were located within the H12640 survey area.

D1.e Uncharted Features

No uncharted features were located within the H12640 survey area.

D1.f Dangers to Navigation

No Dangers to Navigation (Dtons) were reported for this survey.

D1.g Shoal and Hazardous Features

No shoals or potentially hazardous features were located within the H12640 survey area.

D1.h Channels

The H12640 survey area does not contain any anchorage areas, maintained navigation channels or channel lines.

D1.i Bottom Samples

There was no bottom sample requirement for this survey.

D2. ADDITIONAL RESULTS

D2.a Shoreline

Shoreline investigation was not assigned for this project.

D2.b Prior Surveys

Aside from previously discussed charted comparisons, no comparisons with prior surveys were conducted.

D2.c Aids to Navigation

A red nun buoy is charted at 17-39-01.75N, 064-54-34.27W and was found to be located in the approximate charted location.

D2.d Overhead Features

There were no overhead bridges, cables, or other structures which would impact overhead clearance in the survey area.

D2.e Submarine Features

The H12640 survey area contained no submarine features.

D2.f Ferry Routes and Terminals

There were no ferry routes or terminals within the survey area.

D2.g Platforms

There were no platforms within the survey area.

D2.h Significant Features

No additional information of scientific or practical value was observed during the survey other than the benthic habitat characterization maps created by the scientific party. No anomalous tidal or environmental conditions were observed during the survey that impacted the quality of the survey.

D2.i Construction and Dredging

There were no construction or dredging activities observed during survey operations.

D3. NEW SURVEY RECOMMENDATIONS

No recommendations for further charting in the Southwest Shoal region are suggested by the hydrographer.

D3.a Inset Recommendations

No inset recommendations are requested at this time for the surveyed area.

E. APPROVAL SHEET

As Lead Hydrographer, I have ensured that standard field surveying and processing procedures were followed in producing this examination in accordance with the Office of Coast Survey Hydrographic Surveys Division's Field Procedures Manual, and the Hydrographic Surveys Specifications and Deliverables. Field operations for this basic hydrographic survey were conducted under my daily supervision with frequent checks of progress and adequacy.

All field sheets, this Descriptive Report, and all accompanying records and data are approved. All records are forwarded for final review and processing to N/CS33, Atlantic Hydrographic Branch.

The Data Acquisition and Processing Report for M-I907-NF-14 is submitted separately and contains additional information relevant to this survey.

Michael Stecher
NOAA Contractor
Lead Hydrographer
CCMA Biogeography Branch