

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

# DESCRIPTIVE REPORT

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Type of Survey: Navigable Area

Registry Number: H12639

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## LOCALITY

State: USVI

Sub-locality: Lang Bank, St Croix

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**2014**

CHIEF OF PARTY  
Timothy Battista

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## LIBRARY & ARCHIVES

DATE: April 2014

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**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: **Lang Bank, St. Croix**

Scale: **1:40,000** Date of Survey: **March 15 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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**APPENDICES**

Appendix I Danger to Navigation Reports  
Appendix II Survey Features Report  
Appendix III Final Progress Sketch and Survey Outline  
Appendix IV Tides and Water Levels  
Appendix V Supplemental Survey Records & Correspondence

## 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
RNC	Raster Navigation Chart
ENC	Electronic Navigation Chart

**Descriptive Report to Accompany Hydrographic Survey H12639**

Project M-I907-NF-14

Locality: Caribbean Sea

Sub-locality: Lang Bank, St. Croix, USVI

Scale 1:40,000

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, Lang Bank St Croix, US Virgin Islands. Survey H12639 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 H12639 survey limits are listed in Table 1.

**Table 1.** H12639 Survey Limits

<b>Northeast Limit</b>	<b>Southwest Limit</b>
17.81 N	17.80 N
64.55 W	64.43 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 echsounder and will be utilized by the Office of Coast Survey (OCS) to update the nautical charts in the surveyed area.

**A3. SURVEY QUALITY**

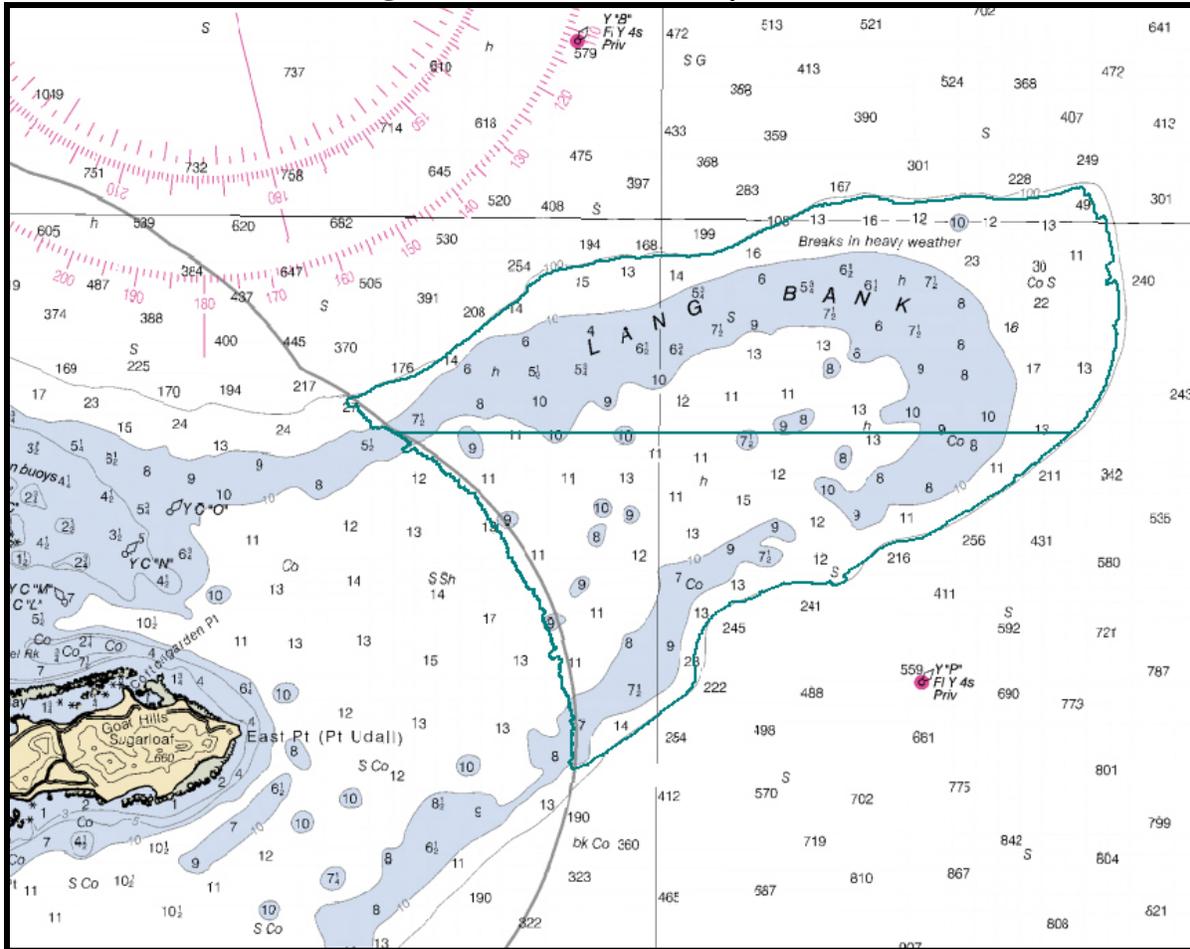
The entire survey is adequate to supersede previous surveys.

**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. H12639 Survey Outline**



**A5. SURVEY STATISTICS**

Detailed survey statistics for H12639 are provided in Table 2.

**Table 2. H12639 Hydrographic Survey Statistics**

Survey Statistics	MBES
MBES main scheme (nm)	595.0
Crosslines (MBES nm)	31.7
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	18.58

Data acquisition was conducted from March 15, 2014 (DN 074) 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.** H12639 Days of Acquisition

Dates of Acquisition	
March	15-23, 30-31
April	1-2
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

<b>NOAA Ship Nancy Foster</b>	
	
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

<b>Type</b>	<b>Manufacturer</b>	<b>Model</b>
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 M-I907-NF-14 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 31.7 nautical miles of crosslines, or 5.3% of all survey lines, were run for analysis of survey accuracy. 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

<b>Total Propagated Uncertainty Computation in CARIS HIPS*</b>		
<b><i>Tide Values</i></b>	<b>Uncertainty* (m)</b>	<b>Day Number Range</b>
Tide Value Measured	0.025	all
Tide Value Zoning	0.05	all
<b><i>Sound Speed Values</i></b>	<b>Uncertainty* (m/s)</b>	
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 5.54 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.

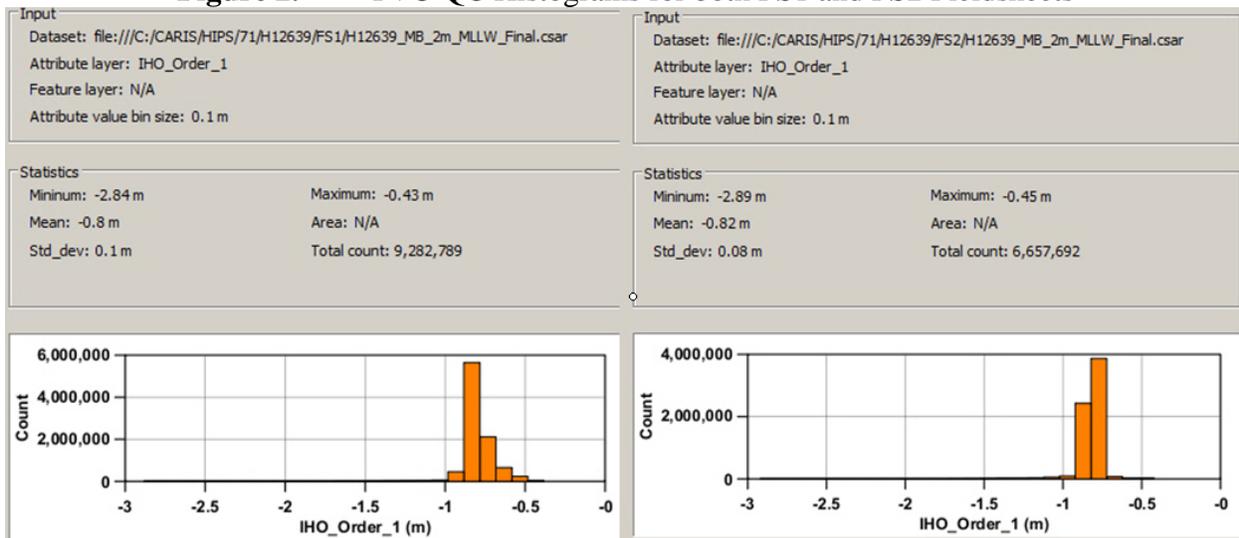
To determine if surface grid nodes met International Hydrographic Organization (IHO) Order 1 specifications a Total Vertical Uncertainty Quality Check (TVU QC) was performed. This

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**

Two lines of HDCS data did not take the Trueheave corrections appropriately. The lines affected are line number 008\_0000 from DN075, and 028\_1043 from DN080. When Trueheave was applied it seemed to introduce a timing error in the heave application. The real time heave was used instead of Trueheave for the two mentioned files.

### **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 out 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 was 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. 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.** H12639 Multibeam Surfaces (FS1 and FS2)

Surface Name	Resolution
H12639_MB_1m_MLLW_Final (Depth_TH)	1.0m
H12639_MB_2m_MLLW_Final (Depth_TH)	2.0m
H12639_MB_4m_MLLW_Final (Depth_TH)	4.0m
H12639_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 H12639 shoal biased selected sounding layer generated in Caris to the affected RNC and ENC charts listed in the Project Instructions. A 160-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 RNCs covering the survey area to H12639 using visual comparison techniques. The RNCs are listed in Table 11.

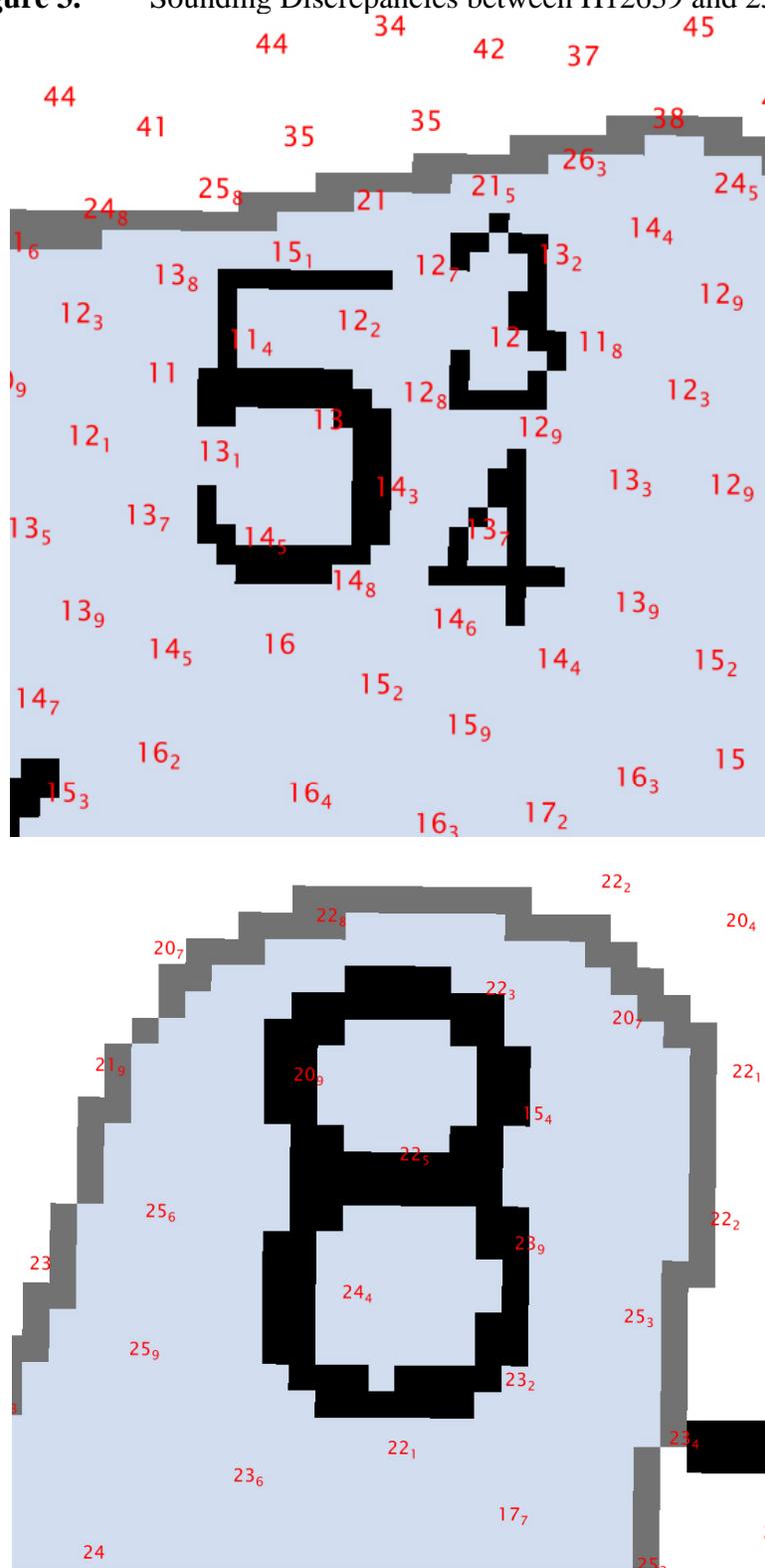
**Table 11. RNCs Compared to H12639**

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

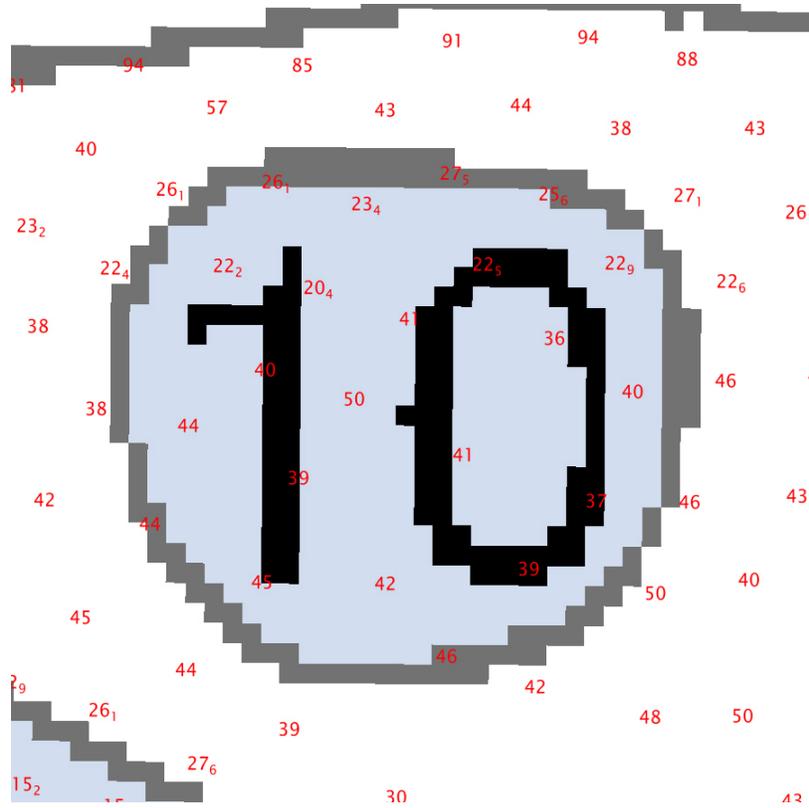
**25640**

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 H12639 and 25640



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



**25641**

This RNC did not have coverage within the H12639 survey limits

**25640**

This RNC did not have coverage within the H12639 survey limits

**D1.b Electronic Navigational Charts**

Table 12 lists the ENC's compared to H12639.

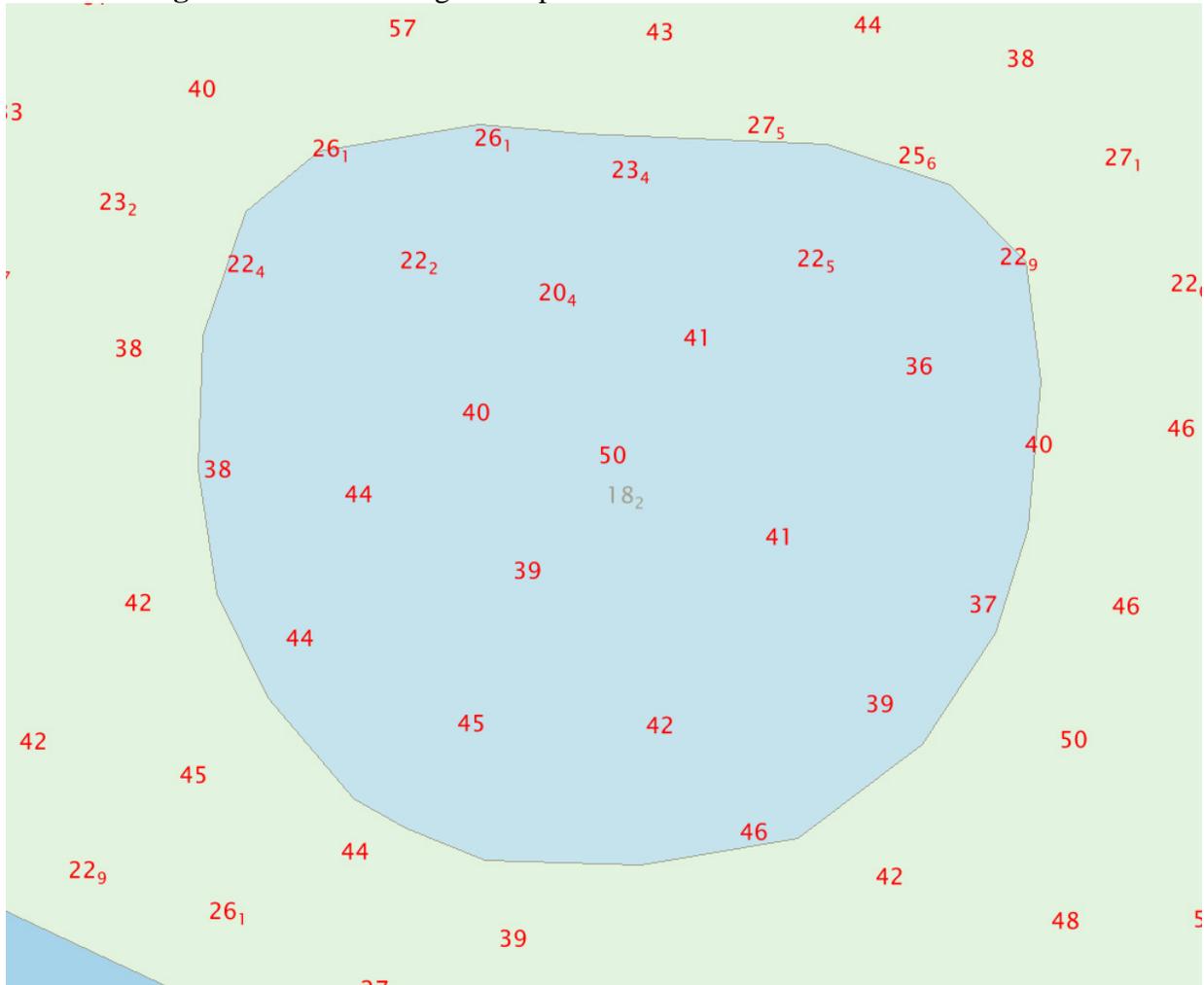
**Table 12.** ENC's Compared to H12639

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

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 examples of multiple discrepancies where ENC soundings were shoaler or mis-charted than the current surveyed soundings.

**Figure 4.** Sounding Discrepancies between H12639 and US3PR10M



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



### **D1.e Uncharted Features**

No uncharted features were located within the H12639 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 H12639 survey area.

### **D1.h Channels**

The H12639 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**

No Aids to Navigation (Atons) were charted or located within the H12639 survey area.

### **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 H12639 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 Lang Bank 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