W00468

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Ocean Service

DESCRIPTIVE REPORT

Type of Survey: Habitat Mapping

Registry Number: W00468

LOCALITY

State(s): Puerto Rico

General Locality: Northeast Caribbean Sea

Sub-locality: Vicinity of Guanica and Ponce

2018

CHIEF OF PARTY
Timothy Battista

LIBRARY & ARCHIVES

Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**W00468**

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(s):	**Puerto Rico**
General Locality:	**Northeast Caribbean Sea**
Sub-Locality:	**Vicinity of Guanica and Ponce**
Scale:	**20000**
Dates of Survey:	**06/29/2018 to 07/06/2018**
Instructions Dated:	**N/A**
Project Number:	**ESD-AHB-18**
Field Unit:	**NOAA Ship *Nancy Foster***
Chief of Party:	**Timothy Battista**
Soundings by:	**Kongsberg Maritime EM 2040 (MBES)** **Kongsberg Maritime EM 710 (MBES)**
Imagery by:	**N/A**
Verification by:	**Atlantic Hydrographic Branch**
Soundings Acquired in:	**meters at Mean Lower Low Water**

Remarks:

Any revisions to the Descriptive Report (DR) applied during office processing are shown in red italic text. The DR is maintained as a field unit product, therefore all information and recommendations within this report are considered preliminary unless otherwise noted. The final disposition of survey data is represented in the NOAA nautical chart products. All pertinent records for this survey are archived at the National Centers for Environmental Information (NCEI) and can be retrieved via https://www.ncei.noaa.gov/. Products created during office processing were generated in WGS84 UTM 19N, MLLW. All references to other horizontal or vertical datums in this report are applicable to the processed hydrographic data provided by the field unit.

DESCRIPTIVE REPORT SUMMARY

A. Area Surveyed

This hydrographic survey was conducted without formal project instructions. The registry number, W00468, was provided after data acquisition had been completed. The survey was referred to as NF-18-04 during field acquisition.

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
17° 57' 52" N 66° 58' 29" W	17° 50' 26" N 66° 33' 37" W

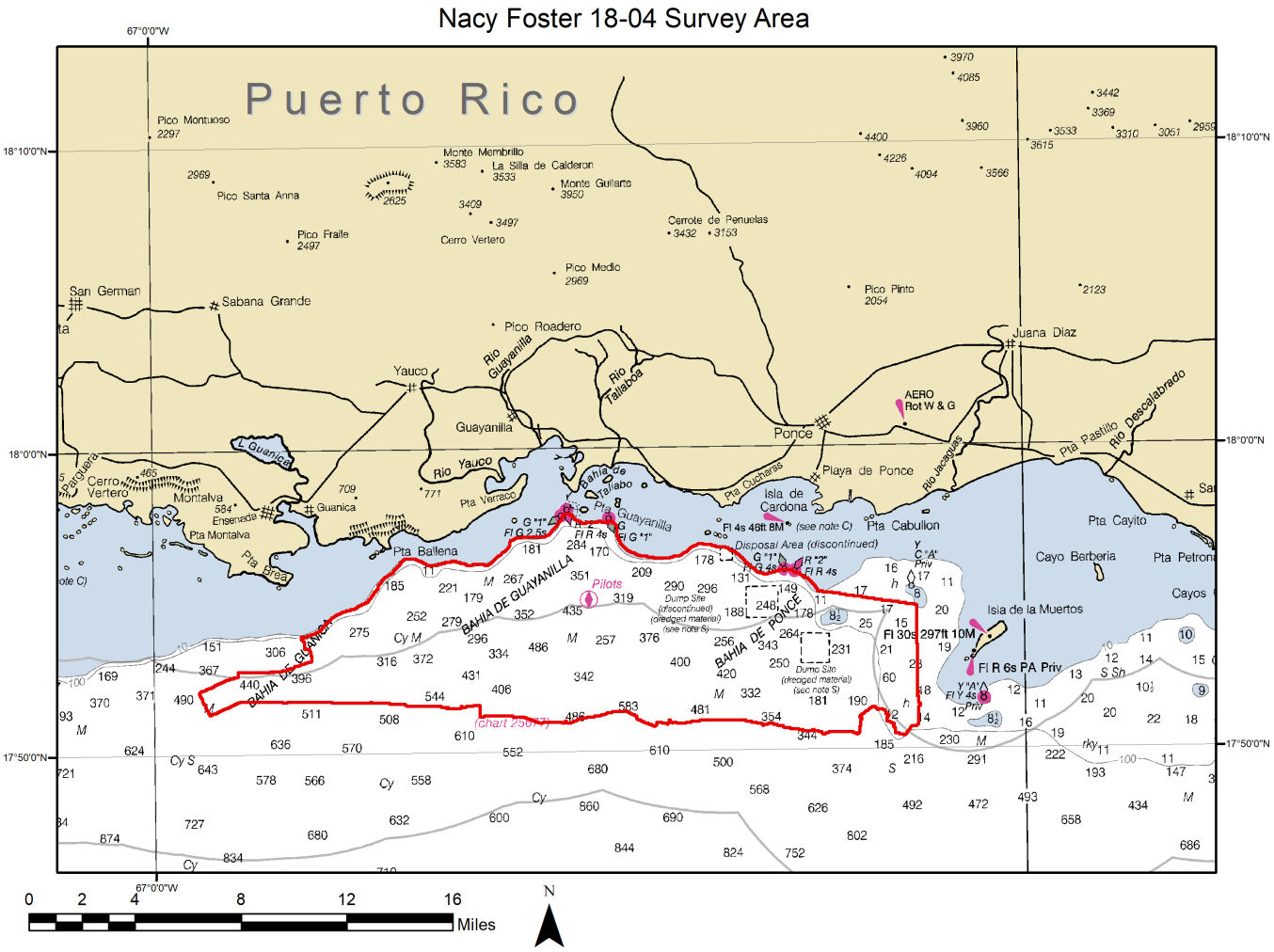

Figure 1: Survey Area (red)

B. Survey Purpose

The project was conducted to provide bathymetric and acoustic backscatter data in support of essential fish habitat research, benthic habitat mapping and nautical charting purposes.

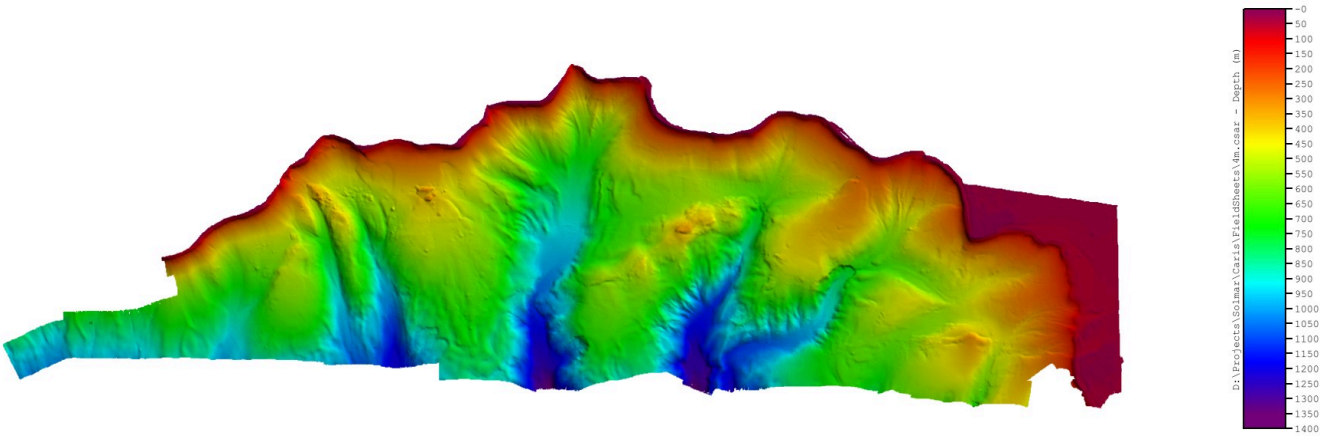

Figure 2: 4m CUBE Surface

C. Intended Use of Survey

The entire survey is adequate to supersede previous data.

The survey is recommended for charting.
Data were acquired and processed to meet IHO Order 1 specifications.
Water column data was concurrently collected at times for fisheries acoustic research purposes.

D. Data Acquisition and Processing

No Data Acquisition and Processing Report is provided with this survey; however systems used to acquire and review data are summarized briefly below.

Data Acquisition and Processing
Equipment
The NOAA ship Nancy Foster (R352) was the platform for this survey. Survey equipment is provided in the Table: Major Survey Components.

HIPS Vessel File (HVF)
The Processor made no edits to the field supplied vessel file.

Sound Speed

An OceanScience uCTD was the primary sound velocity acquisition device. The uCTD was deployed in approximately 3.5 hour increments during survey and actions were taken to distribute the casts evenly throughout the survey area. Sound speed was applied in real time to the multibeam data in the SIS acquisition system. The latitude is incorrect for the sound speed taken on DN178 at 23:54:00; this does not impact the data as sound speed is applied in real time. For review purposes a concatenated sound speed file with modified longitude (in order to display correctly in CARIS) has been provided.

Quality Control

Crosslines

Multibeam crosslines were acquired across all depth ranges, water masses, and over several days. Crossline data are adequate for verifying and evaluating the internal consistency of survey data. 27 nautical miles of crosslines were acquired for a total of 6% of main scheme hydrography. The CARIS crossline report was reviewed for adherence to IHO Order 1 specification. Beams 396 through 400 on the EM2040 failed to meet IHO Order 1 specifications, so these beams were rejected prior to creating deliverable surfaces. The crossline report is provided in Separates II.

Statistics derived from differencing a variable resolution CUBE surface of main scheme data from a variable resolution CUBE surface of crossline data demonstrates the acquisition systems were within the allowable Total Vertical Uncertainty (TVU) specified in the 2018 Hydrographic Surveys Specifications and Deliverables (HSSD). The mean difference is -0.05m with a standard deviation of 0.886m. Please refer to Figure: Computed Statics for Main Scheme vs. Crossline Difference Surface.

NOAA's QC Tools 2 (version 7) was used to generate a .HOB file of potential fliers. All potential fliers were then reviewed, validated, or flagged as rejected, in CARIS subset mode.

Junctions

No junction comparisons were required for this survey.

Sonar Quality Control

There were no deviations from typical NOAA quality control checks.

Equipment Effectiveness

There were no conditions or deficiencies that affected equipment operational effectiveness.

Factors Affecting Soundings

Line 0035_20180630_040942_NancyFoster appears to have a sound speed refraction error. To reduce the magnitude of the error, the outer beams have been rejected (Figure: Sound Speed Error).

Corrections to Echo Soundings

Corrections

Data processing followed the typical CARIS HIPS CUBE processing pipeline for a Kongsberg system (motion, attitude and sound speed applied in real-time) with the exception of tidal reduction, which was

completed using a NOAA-supplied TCARI grid (NF-18-04.tc). The TCARI correction occurs outside of CARIS HIPS and is not reflected in the HIPS Log Viewer.

Calibrations

Calibrations were conducted between June 27, 2018 and July 3, 2018 (DN178-184) for the Kongsberg EM2040 System Acceptance Test conducted by NOAA personnel. Calibration tests for the EM710 were conducted on June 27, 2018 (DN178). CARIS HDCS data for the calibration testing is included with this delivery.

Backscatter

Acoustic backscatter was collected with both Kongsberg systems for benthic habitat delineation and chart creation. The National Centers for Coastal Ocean Science Biogeography Branch, Marine Spatial Ecology Division is processing the backscatter and data will be included with the final deliverables.

Water Column

Water column data was acquired to map fish aggregations along the reef shelfs at times determined by the fisheries biologists. Water column data was not collected for the entire project. The water column data was not used during processing but is included in the raw data folders.

Data Processing

Software Updates

There are no processing software updates to report.

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 using the CUBEParams_NOAA_2018.xml file. Survey depths vary from 10m to over 1300m.

The final depth resolution for the single resolution surface was determined by computing statistics on the depth layer in CARIS and generating a CUBE surface at the resolution required for the largest depth bin: 40m (4m surface resolution).

A variable resolution grid was created using "Ranges" for the estimation method. Default parameters were used for the estimation method with the exception of the range file which was edited to be in line with the range resolution defined in the HSSD and "Keep Partial Bins" was selected. CUBE was selected for the population method and default parameters were used with the exceptions of Display Bias in which,"Highest" was selected. The NOAA CUBE parameter file, CUBEParams_NOAA_2018.xml, was selected using the "NOAA_VR" configuration for "CUBE Configuration." The edited depth ranges and the NOAA cube parameter file have been provided in the root of the HDCS_Data folder.

Type	*Manufacturer*	*Model*
Multibeam Echosounder	Kongsberg	EM710
Multibeam Echosounder	Kongsberg	EM2040
Primary Sound Speed Profiler	OceanScience	uCTD
Secondary Sound Speed Profiler	Sea-Bird	SBE-19
Positioning & Attitude	Applanix	POS/MV 320 v5
Positioning & Attitude	Trimble	BD982

Figure 3: Major Survey Components

Figure 4: NOAA Ship Nancy Foster

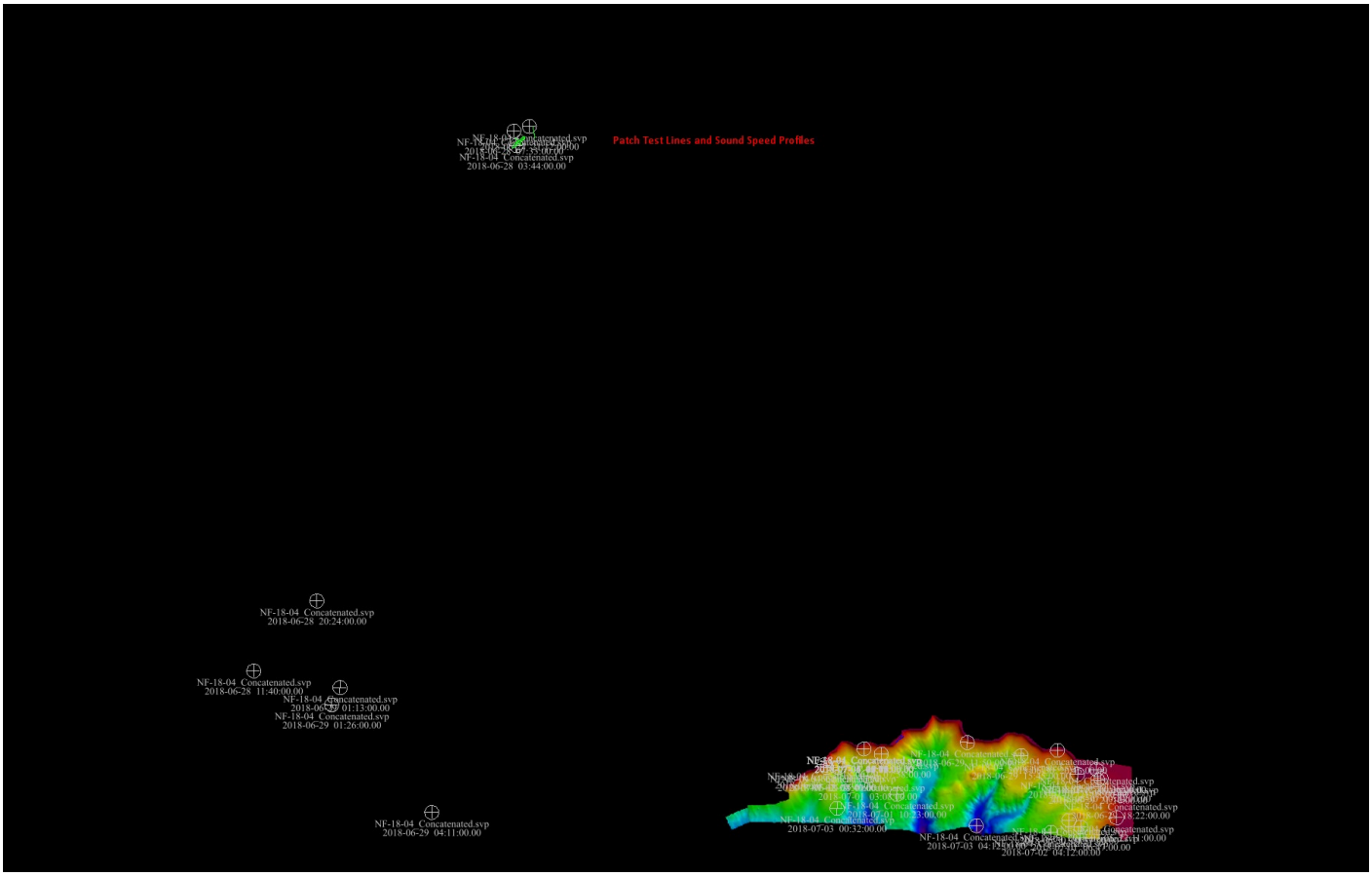

Figure 5: Spatial Distribution of Sound Speed Casts (Including Patch Test Area)

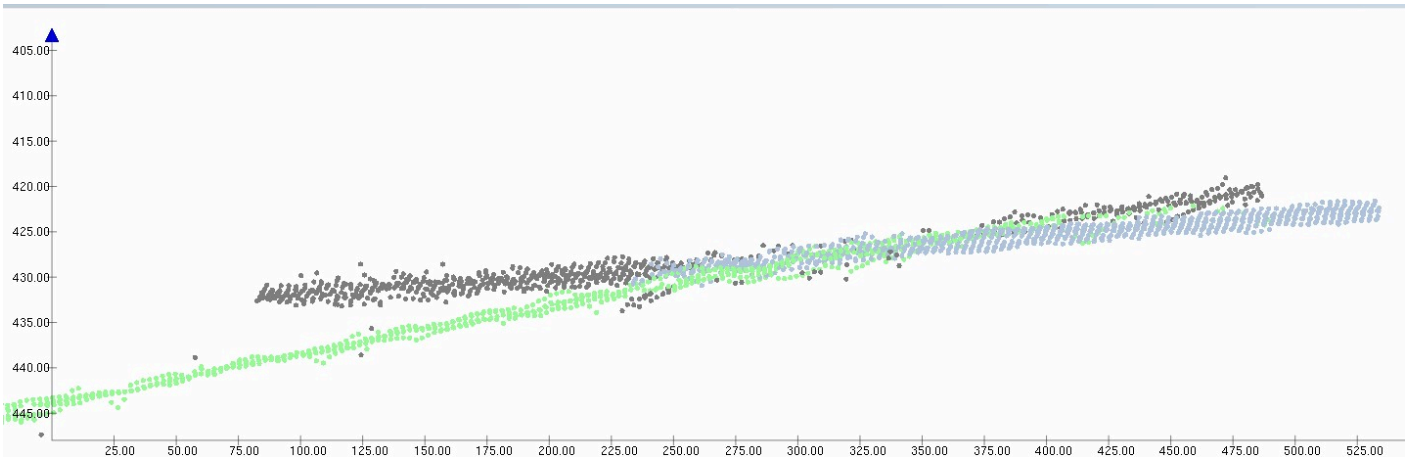

Figure 6: Sound Speed Error on Line 0035_20180630_040942_NancyFoster

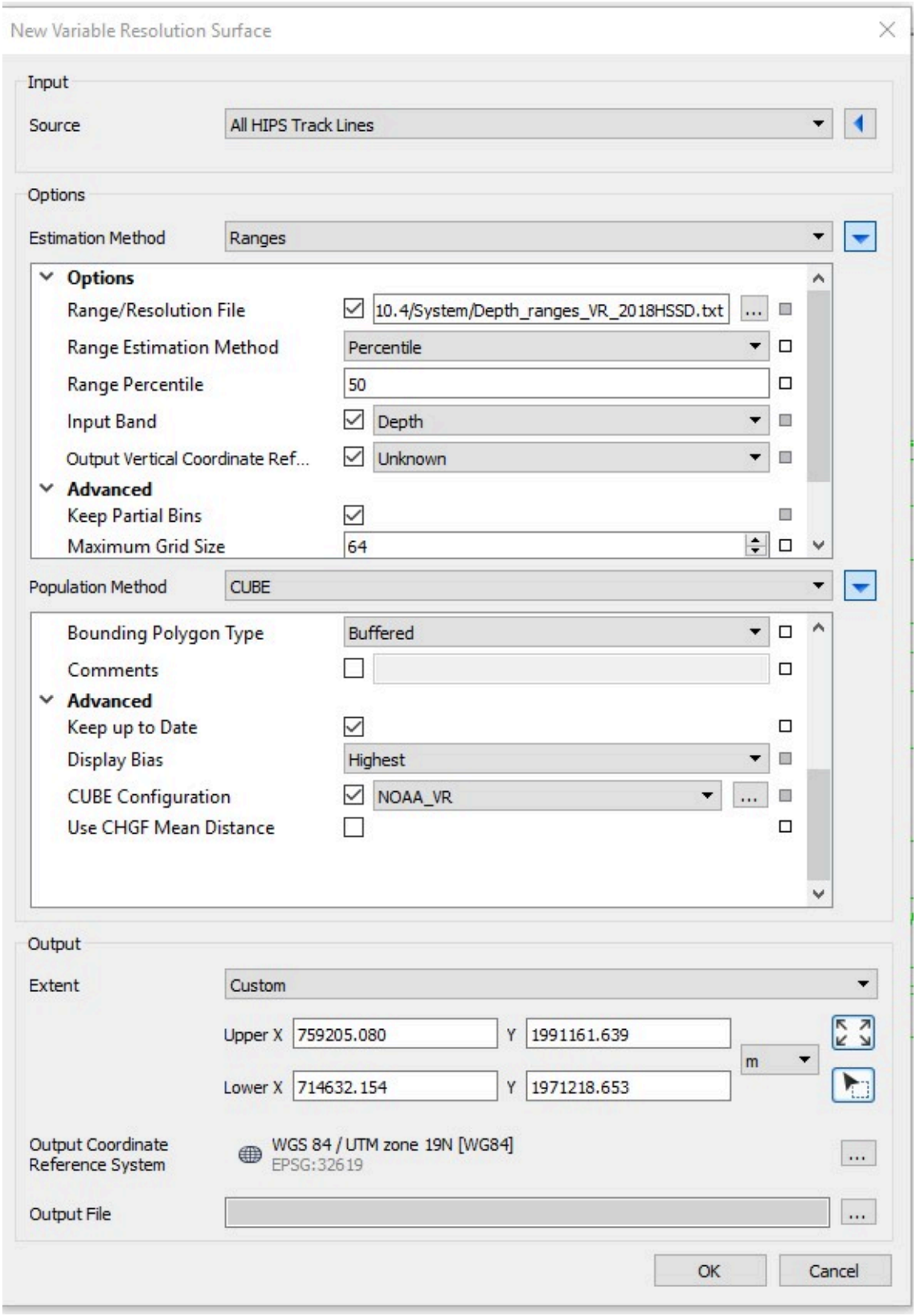

Figure 7: Variable Resolution Surface Parameters

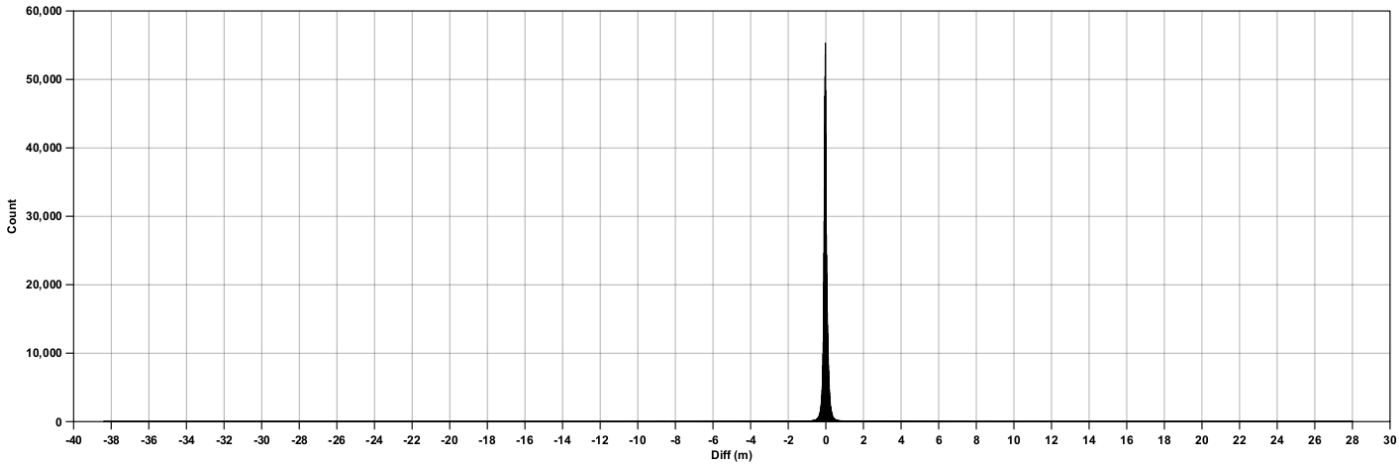

Figure 8: Computed Statics for Main Scheme vs. Crossline Difference Surface

E. Uncertainty

Results from the crossline analysis, final CUBE surface uncertainties, the TVU QC, and standard deviation statistics computed for the surface indicate internal consistency of the MBES data within IHO Order 1 specifications (Figure: Uncertainty Standards for Variable Resolution CUBE Surface).

TPU
Offsets
Vessel offsets for the Nancy Foster were applied during data acquisition. In order to properly apply uncertainty in CARIS, vessel offsets were also included in the TPU section of the CARIS HIPS Vessel File (HVF). To verify the applied offsets a raw Kongsberg .ALL file for each system was dumped to a text file and the vessel offsets extracted for each system. These offsets were reviewed against the offsets entered in the HVF for the TPU lever arms. Using this method the MRU to Transducer offsets were verified for both multibeam systems. The Reference point to GNSS Antenna lever arms entered in the POS MV were reviewed against the Nav to Trans entry.

Uncertainty Sources
Survey specific uncertainty parameters for tide and sound speed are included in the Table: Compute HIPS TPU Options. The TCARI methodology for tidal correction creates an uncertainty model by propagating water level uncertainties, datum uncertainties, and TCARI grid vertical uncertainties. This error budget overwrites previously-defined error sources in CARIS and is applied as part of the TPU processing. During surface finalization in HIPS, the "Uncertainty" option was selected.

Uncertainty Evaluation
The survey was reviewed using NOAA's Pydro's Grid QA tool (version 5) to evaluate compliance against the HSSD resolution and density requirements for Complete Coverage. Results are provided in the "support" folder with this report and selected graphs are presented below. 99.5% of grid nodes meet the maximum

allowable TVU. 99.7% of grid nodes are populated with at least 5 soundings and 99% of all surface nodes have a resolution equal to or smaller than the coarsest allowable resolution for the node depth.

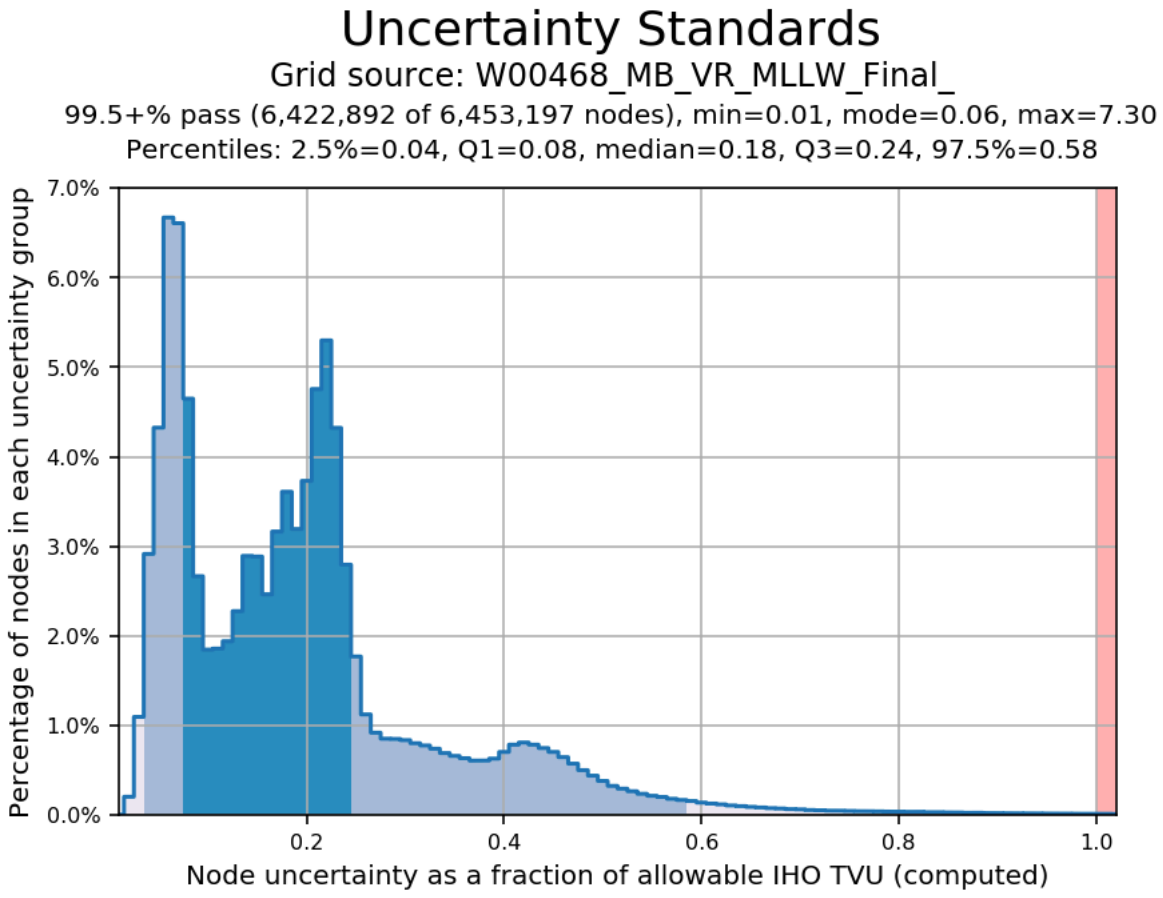

Figure 9: Uncertainty Standards Variable Resolution CUBE Surface

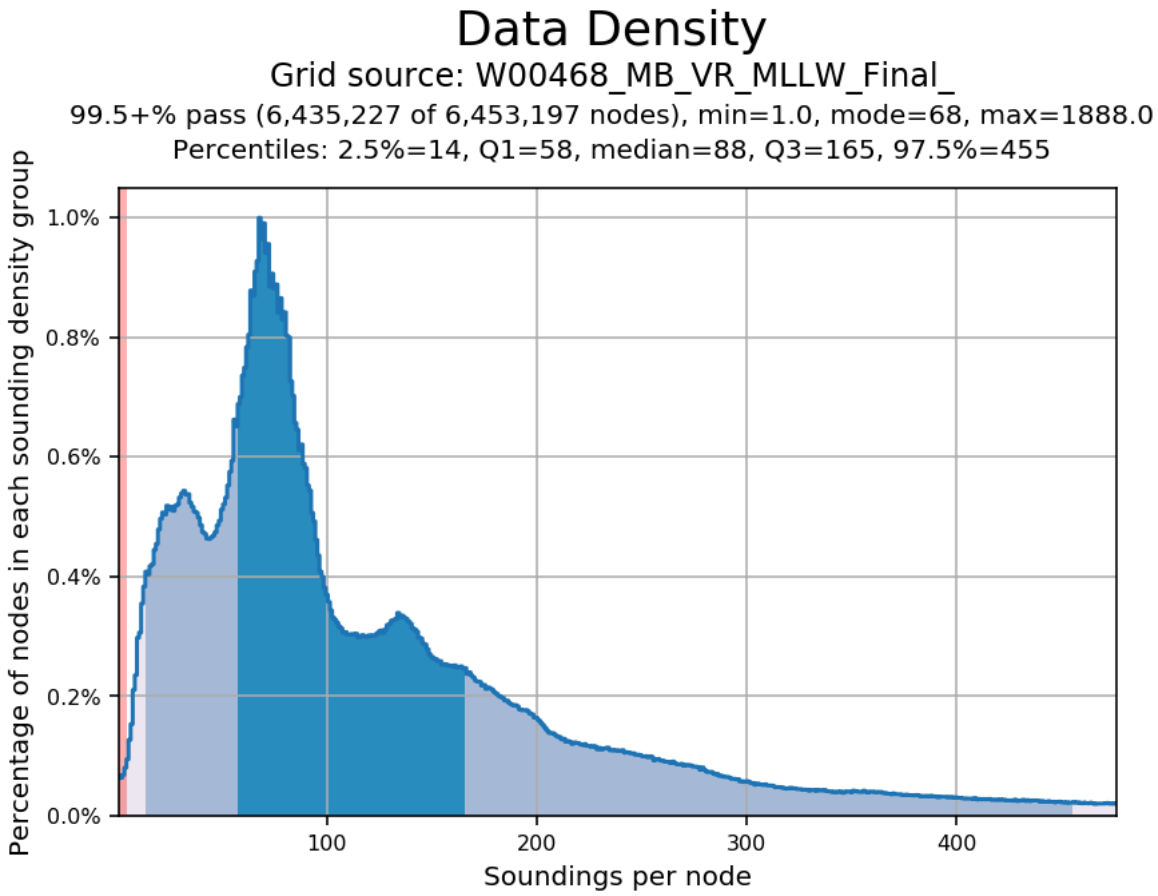

Figure 10: Density for Variable Resolution CUBE Surface

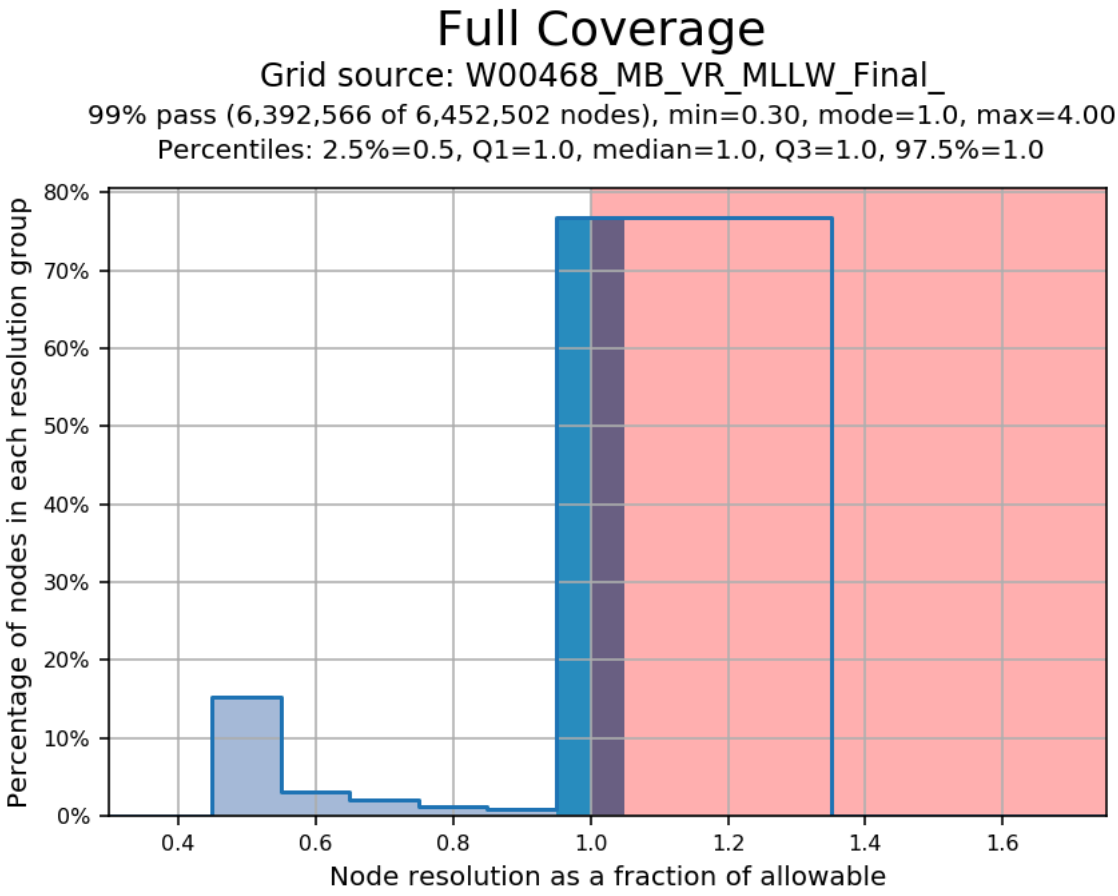

Figure 11: Resolution for Variable Resolution CUBE Surface

Options	
Gyro Source	VESSEL
Heave Source	VESSEL
Navigation Source	VESSEL
Pitch Source	VESSEL
Roll Source	VESSEL
Sonar Source	VESSEL
Tide Source	STATIC
Measured Sound Velocity	4 m/s
Surface Sound Velocity	0.2 m/s
Sweep Maximum Heave	0 m
Sweep Maximum Pitch	0 deg
Sweep Maximum Roll	0 deg
Measured Tide	0.01 m
Tide Zoning	0.2 m

Figure 12: Compute HIPS TPU Options

F. Results and Recommendations

The following are the largest scale ENCs, which cover the survey area:

ENC	Scale	Edition	Update Application Date	Issue Date
US4PR41M	1:100000	11	10/10/2018	10/10/2018
US5PR42M	1:20000	16	06/12/2018	06/12/2018
US4PR60M	1:100000	15	10/16/2018	10/16/2018
US3PR10M	1:326856	20	02/14/2018	02/14/2018
US5PR44M	1:10000	11	09/27/2018	09/27/2018

The following surfaces and/or BAGs were submitted to the Processing Branch:

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
W00468_MB_4m_MLLW_Final	CUBE	4 m	10.8 m - 1356.9 m	Final	Single Resolution Coverage
W00468_MB_4m_MLLW_Interp_Final	CUBE	4 m	10.8 m - 1356.9 m	Interpolated	Coverage with Small Holidays Interpolated
W00468_MB_VR_Final	CUBE	Variable m	10.4 m - 1356.8 m	Final	Variable Resolution Coverage

The chart comparison was performed by differencing a triangulated irregular network (TIN) surface of the survey depths against ENCs depths in ArcGIS (see Figure: ENC and Survey Differences). There are significant differences between the chart and survey, however the survey is generally deeper than what is typically considered significant for navigation.

US5PR42M
The survey found some minor shoaling on the eastern bank (See Figure: Chart Comparison).

Additional affected RNCs:
25640

25677
25685
25687
25683

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

Shoal and Hazardous Features
No shoals or potentially hazardous features were located within the survey area.

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

Bottom Samples
There was no bottom sample requirement for this survey.

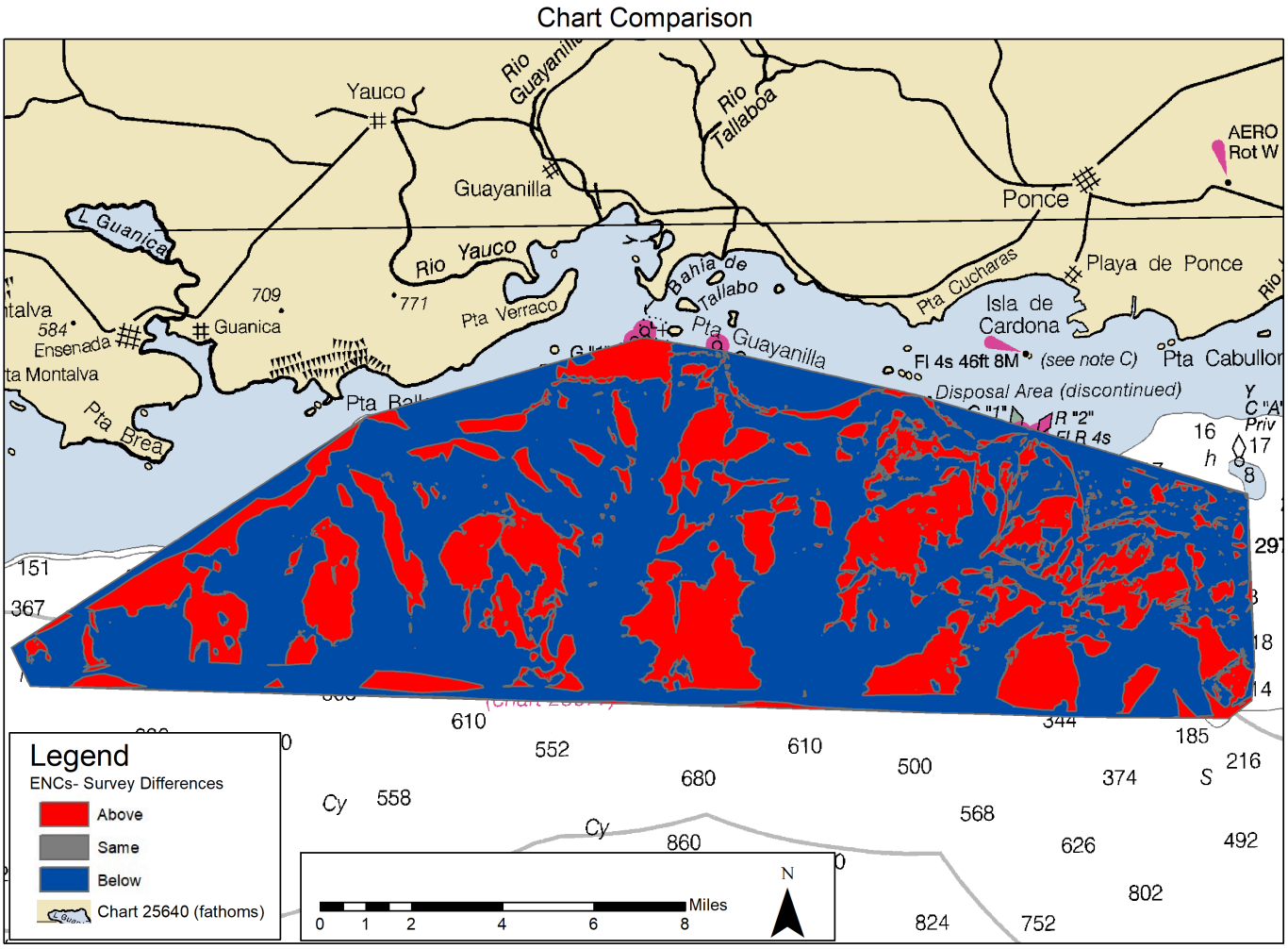

Figure 13: ENC and Survey Differences (red=ENC depths less than surveyed, blue=ENCs depths greater than surveyed)

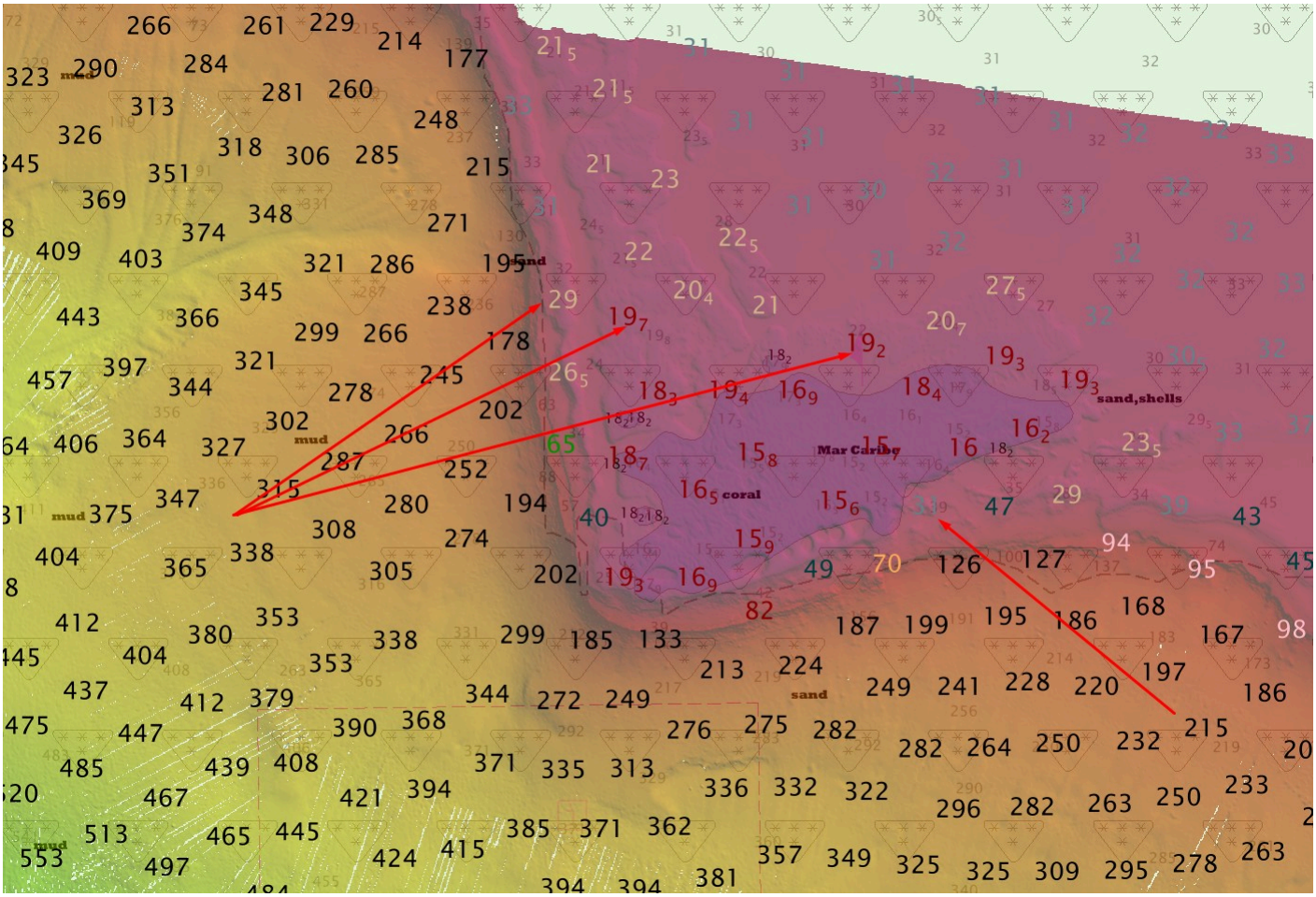

Figure 14: Chart Comparison (survey soundings in meters overlaid on ENC US5PR42M)

G. Vertical and Horizontal Control

The vertical datum for this project is Mean Lower Low Water. The vertical control method used was TCARI.

The following National Water Level Observation Network (NWLON) stations served as datum control for this survey:

Station Name	Station ID
Christiansted Harbor	9751364
Lime Tree Bay	9751401
San Juan	9755371
Magueyes Island	9759110
Mona Island	9759938

The NWLON stations provided residuals for this project.
The vertical datum for this project is MLLW. Tidal data was applied with a finalized TCARI grid (NF-18-04.tc) supplied by CO-OPS with verified tides values obtained from the assigned NWLON tide gauges.

The horizontal datum for this project is North American Datum of 1983 (NAD 83). The projection used for this project is Universal Transverse Mercator (UTM) Zone 19.

Depths delivered in meters.

The horizontal datum is WGS84 UTM 19N.

H. Additional Results

Shoreline

Shoreline investigation was not assigned for this project.

Prior Surveys

No comparisons with prior surveys were conducted.

Aids to Navigation

The survey area did not contain any lights or buoys.

The survey contained two areas designated for pilot-cruising vessels, these areas were not specifically addressed by this survey.

Overhead Features

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

Submarine Features

No cables were observed on the seafloor.

Ferry Routes and Terminals

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

Platforms

There were no platforms within the survey area.

Dumping Grounds

The survey area contains three areas designated as dumping grounds, nothing exceptional were noted within these boundaries.

Significant Features

The dynamic seafloor contained within the survey area is of particular interest for mapping essential fish habitat.

Construction and Dredging

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

New Survey Recommendation

No new survey or further investigations are recommended for this area.

Inset Recommendations

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

I. Approval

As Chief of Party, field operations for this hydrographic survey were conducted under my direct supervision, with frequent personal checks of progress and adequacy. I have reviewed the attached survey data and reports.

All field sheets, this Survey Summary Report, and all accompanying records and data are approved. All records are forwarded for final review and processing to the Processing Branch.

The survey data meets or exceeds requirements as set forth in the NOS Hydrographic Surveys and Specifications Deliverables, Field Procedures Manual, Standing and Tide Letter Instructions, and all HSD Technical Directives. These data are adequate to supersede charted data in their common areas. This survey is complete and no additional work is required.

Approver Name	Title	Date	Signature
Michael Stecher	Lead Hydrographer	01/29/2019	

APPROVAL PAGE

W00468

Data meet or exceed current specifications as certified by the OCS survey acceptance review process. Descriptive Report and survey data except where noted are adequate to supersede prior surveys and nautical charts in the common area.

The following products will be sent to NCEI for archive

- Descriptive Report
- Collection of Bathymetric Attributed Grids (BAGs)
- Processed survey data and records
- Geospatial PDF of survey products
- Collection of backscatter mosaics

The survey evaluation and verification have been conducted according to current OCS specifications, and the survey has been approved for dissemination and usage of updating NOAA's suite of nautical charts.

Approved: Meghan Mcgovern 2021.02.23 14:01:31 -05'00'

Commander Meghan McGovern, NOAA
Chief, Atlantic Hydrographic Branch