H13758

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H13758

LOCALITY

State(s):	North Carolina
General Locality:	Albemarle Sound
Sub-locality:	Central Albemarle Sound

2023

CHIEF OF PARTY
Nicholas Damm, CH

LIBRARY & ARCHIVES

Date:

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

REGISTRY NUMBER:

HYDROGRAPHIC TITLE SHEET

H13758

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):	**North Carolina**
General Locality:	**Albemarle Sound**
Sub-Locality:	**Central Albemarle Sound**
Scale:	**5000**
Dates of Survey:	**02/28/2023 to 10/27/2023**
Instructions Dated:	**02/14/2023**
Project Number:	**OPR-F330-KR-22**
Field Unit:	**Geodynamics LLC**
Chief of Party:	**Nicholas Damm, CH**
Soundings by:	**Multibeam Echo Sounder**
Imagery by:	**Multibeam Echo Sounder Backscatter Side Scan Sonar**
Verification by:	**Atlantic Hydrographic Branch**
Soundings Acquired in:	**meters at Low Water Datum**

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 NAD83 UTM 18N, LWD. All references to other horizontal or vertical datums in this report are applicable to the processed hydrographic data provided by the field unit.

Table of Contents

List of Tables

List of Figures

Descriptive Report to Accompany Survey H13758

Project: OPR-F330-KR-22

Locality: Albemarle Sound

Sublocality: Central Albemarle Sound

Scale: 1:5000

February 2023 - October 2023

Geodynamics LLC

Chief of Party: Nicholas Damm, CH

A. Area Surveyed

Geodynamics conducted a hydrographic survey in the assigned area of H13758 located in the central Albemarle Sound. Within H13758, all survey operations were conducted in accordance with the provided Statement of Work (SOW), Hydrographic Survey Project Instructions (PI), and the March 2022 National Ocean Service (NOS) Hydrographic Survey Specifications and Deliverables (HSSD). Any deviations from the aforementioned guidelines have been approved by the National Oceanographic and Atmospheric Administration (NOAA) Hydrographic Survey Division (HSD) Operations (OPS) branch and are documented in the survey correspondences.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
36° 10' 28.03" N 76° 9' 37.74" W	35° 57' 17.32" N 75° 55' 43.96" W

Table 1: Survey Limits

Data were acquired to the survey limits in accordance with the requirements listed in the PI and the HSSD.

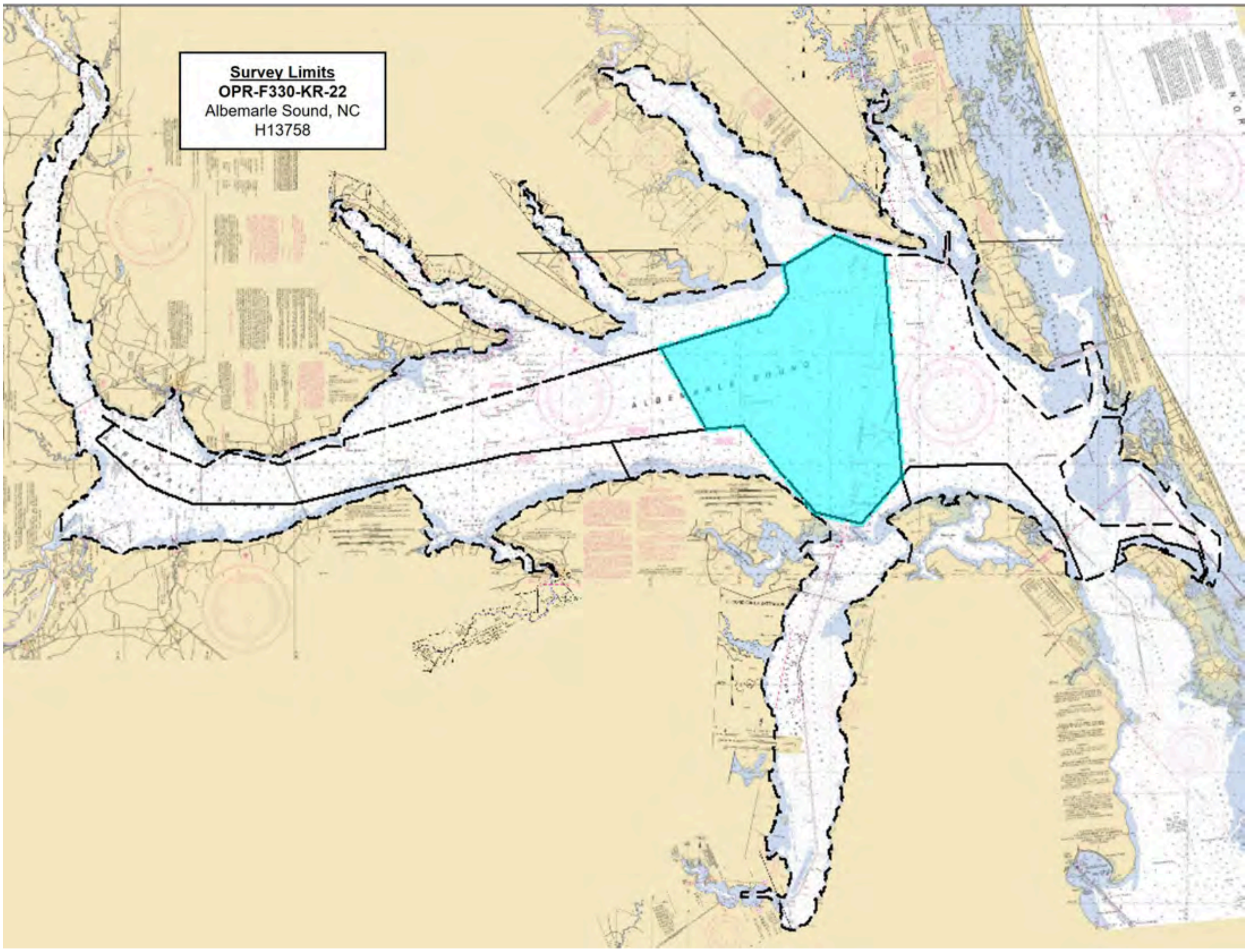


Figure 1: Overview of project survey limits (H13758 shown in blue), overlaid onto Charts 11553, 12205, and 12206

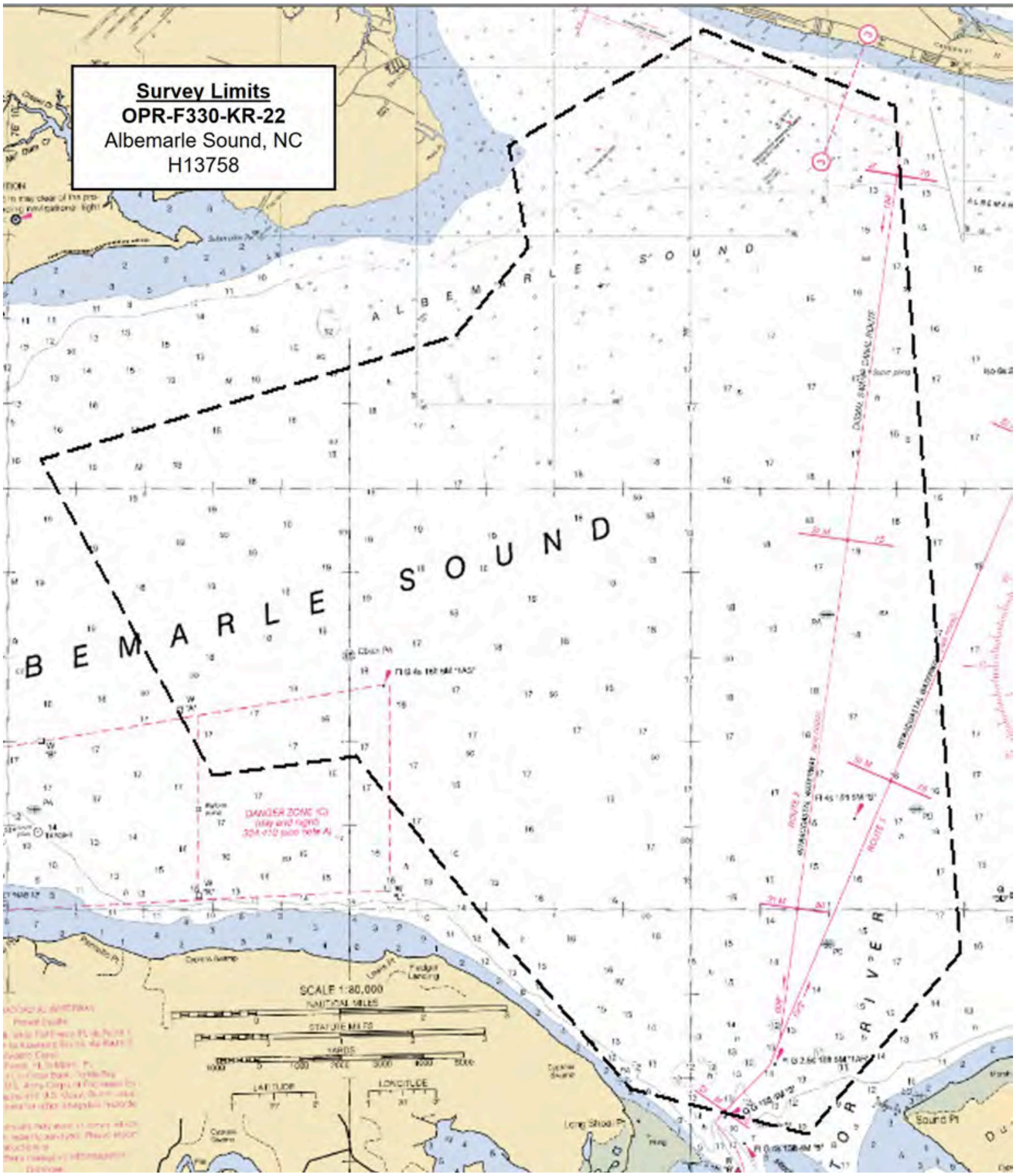


Figure 2: H13758 survey limits overlaid onto Charts 11553, and 12205

A.2 Survey Purpose

Albemarle Sound in North Carolina is a large, shallow, low-salinity estuary which extends approximately 50 nautical miles inland from the Outer Banks barrier islands. For this project, approximately 522 square nautical miles of modern, high-resolution hydrographic data will be collected in Albemarle Sound and connecting rivers.

Commercial and recreational fishing as well as waterfront tourism are important economic drivers for the communities around the sound. Albemarle Sound has been facing recent and drastic decline in water quality and fishing stocks, and since the late 1980s, high levels of contaminants have been documented in the waters and biology of the sound and tributaries. To monitor this situation, the USGS and partners installed a network of monitoring stations as part of a program to study water quality to understand the sources and movement of nutrients and biota. The National Water Center along with the North Carolina Department of Environmental Quality have stated that there is a need for updated bathymetric data in the waterways to inform hydrodynamic models to improve understanding nutrient movement and to predict the effects of future sea-level and coastline change. Data collected by this survey will be used to characterize seabed habitat which will be used to help manage a healthy and sustainable seafood industry and help monitor future changes to the estuary ecology.

This hydrographic survey will update NOAA National Ocean Survey (NOS) charts and products to identify hazards and improve navigation safety in a region which includes areas of high need for modern bathymetry based on the age of the prior data (1920) and the Hydrographic Health model. Survey data from this project are intended to supersede all prior survey data in the common area.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Survey quality in H13758 meets or exceeds requirements set forth in the HSSD. Survey quality was assessed through visual inspection, the analysis of crosslines, and utilizing QC Tools to assess uncertainty and density. Additionally, junction analyses were conducted between overlapping data collected on this project. For more information on methods and results of the survey data quality assessments for this survey, refer to section B.2 of this report.

A.4 Survey Coverage

The following table lists the coverage requirements for this survey as assigned in the project instructions:

Water Depth	Coverage Required
All waters in survey area	Complete Coverage (Refer to HSSD Section 5.2.2.3). While best effort must be made to cover the SSS nadir gap, the specification requiring MBES data to extend completely across the SSS nadir gap is waived in depths less than 3.5m.

Table 2: Survey Coverage

The entirety of H13758 was acquired with complete coverage in accordance with section 5.2.2.3 Option B of the HSSD and coverage requirement adjustments listed in the PI, as shown in Figure 3.

All efforts were made to acquire survey data to the sheet limits or to the Navigable Area Limit Line (NALL), as defined in section 1.3.2 of the HSSD. It should be noted that an exception to the depth that defines NALL, usually 3.5 m, was changed to 2 m at Low Water Datum (LWD) for this project and is stated as such in the PI. An example of where survey limits were defined by NALL due to safety can be seen in Figure 4.

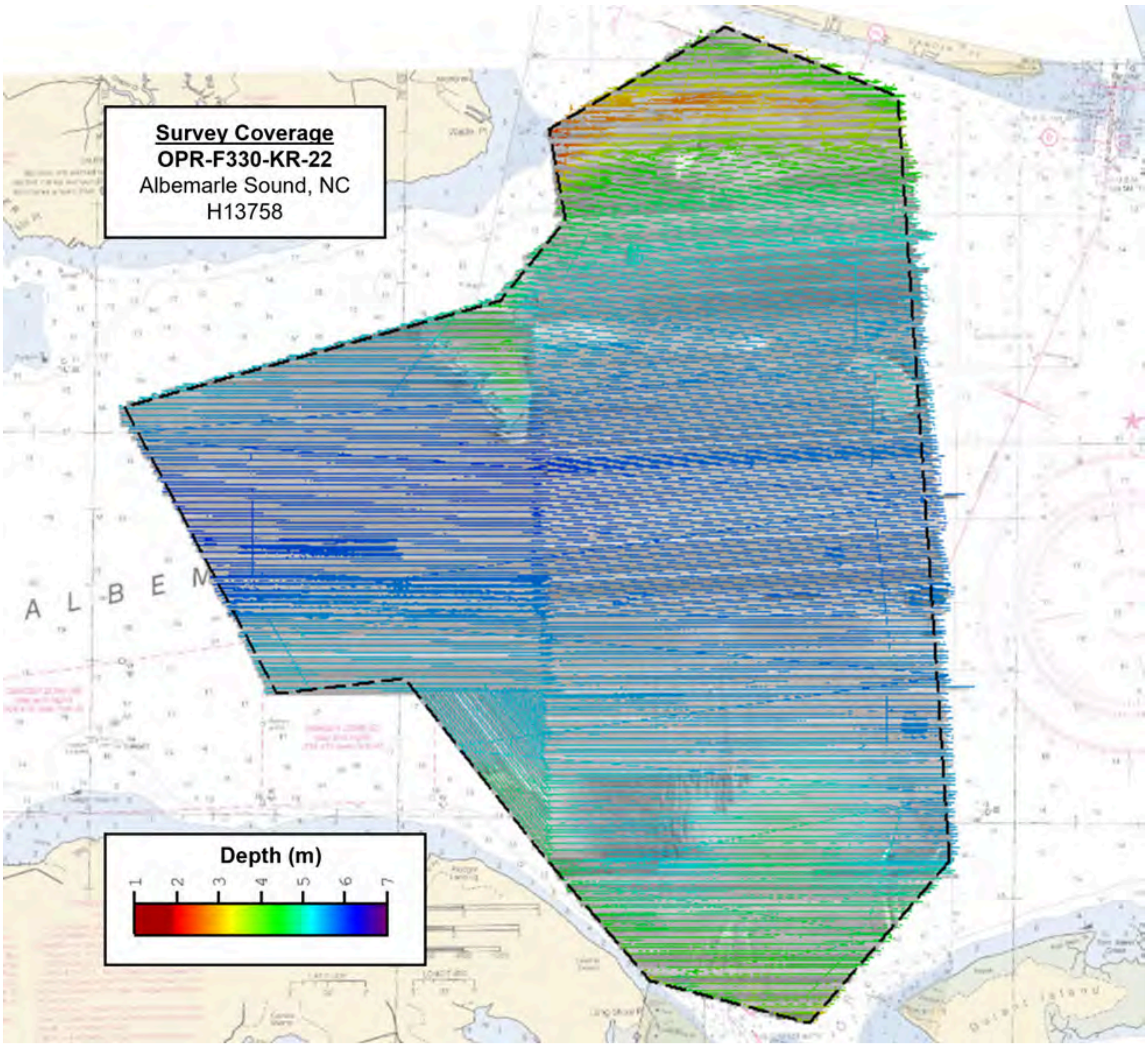


Figure 3: H13758 Complete Coverage SSS (greyscale) with MBES coverage, and assigned sheet limits in black.

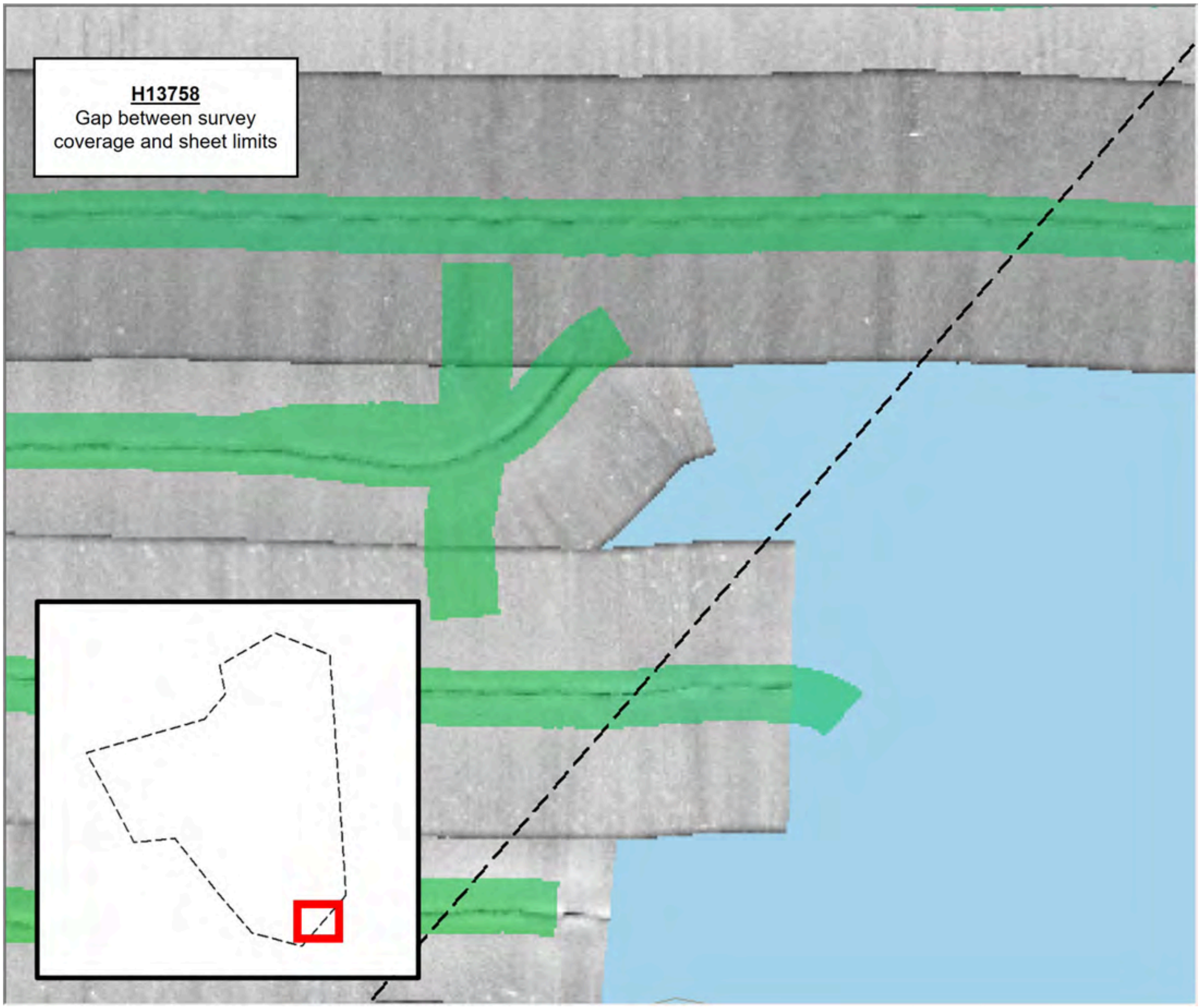


Figure 4: Gap between H13758 survey coverage and sheet limits due to safety NALL met from above water fishing stakes which were submitted as a DTON in neighboring sheet H13762.

A.6 Survey Statistics

The following table lists the mainscheme and crossline acquisition mileage for this survey:

	HULL ID	*R/V 4Points*	*R/V Benthos*	*R/V Chinook*	*R/V Substantial*	*Total*
LNM	**SBES Mainscheme**	0.0	0.0	0.0	0.0	0.0
	MBES Mainscheme	129.25	353.59	307.86	1566.18	2356.88
	Lidar Mainscheme	0.0	0.0	0.0	0.0	0.0
	SSS Mainscheme	120.13	327.87	297.75	1545.96	2291.71
	SBES/SSS Mainscheme	0.0	0.0	0.0	0.0	0.0
	MBES/SSS Mainscheme	0.0	0.0	0.0	0.0	0.0
	SBES/MBES Crosslines	12.2	0.0	11.57	91.91	115.68
	Lidar Crosslines	0.0	0.0	0.0	0.0	0.0
Number of Bottom Samples						1
Number Maritime Boundary Points Investigated						0
Number of DPs						0
Number of Items Investigated by Dive Ops						0
Total SNM						84.2

Table 3: Hydrographic Survey Statistics

The following table lists the specific dates of data acquisition for this survey:

Survey Dates	Day of the Year
02/28/2023	59

Survey Dates	Day of the Year
03/02/2023	61
03/03/2023	62
03/05/2023	64
03/06/2023	65
03/07/2023	66
03/08/2023	67
03/09/2023	68
03/10/2023	69
03/11/2023	70
03/12/2023	71
03/13/2023	72
03/16/2023	75
03/17/2023	76
03/18/2023	77
03/19/2023	78
03/20/2023	79
03/22/2023	81
03/24/2023	83
03/28/2023	87
03/29/2023	88
04/05/2023	95
04/06/2023	96
04/11/2023	101
04/12/2023	102
04/13/2023	103
04/14/2023	104
04/15/2023	105
04/28/2023	118
05/03/2023	123
06/15/2023	166
06/16/2023	167
06/18/2023	169

Survey Dates	Day of the Year
06/19/2023	170
06/25/2023	176
06/28/2023	179
06/29/2023	180
06/30/2023	181
07/01/2023	182
07/05/2023	186
07/06/2023	187
07/07/2023	188
10/20/2023	293
10/22/2023	295
10/23/2023	296
10/24/2023	297
10/27/2023	300

Table 4: Dates of Hydrography

B. Data Acquisition and Processing

B.1 Equipment and Vessels

Refer to the OPR-F330-KR-22 Data Acquisition and Processing Report (DAPR) for a complete description of data acquisition and processing systems, survey vessels, quality control procedures and data processing methods. Additional information to supplement sounding and survey data, and any deviations from the DAPR are discussed in the following sections.

B.1.1 Vessels

The following vessels were used for data acquisition during this survey:

Hull ID	***R/V 4Points***	***R/V Benthos***	***R/V Chinook***	***R/V Substantial***
LOA	7.62 meters	9.14 meters	9.44 meters	18.0 meters
Draft	0.91 meters	0.61 meters	0.61 meters	2.22 meters

Table 5: Vessels Used

B.1.2 Equipment

The following major systems were used for data acquisition during this survey:

Manufacturer	Model	Type
Kongsberg Maritime	EM 2040C	MBES
EdgeTech	4205	SSS
Applanix	POS MV OceanMaster	Positioning and Attitude System
AML Oceanographic	MVP30-350	Sound Speed System
AML Oceanographic	BaseX2	Sound Speed System
AML Oceanographic	AML-3 LGR	Sound Speed System
AML Oceanographic	MicroX SV	Sound Speed System

Table 6: Major Systems Used

All survey vessels utilized a dual-head Kongsberg EM 2040C multibeam system, a POS M/V OceanMaster positioning and attitude system, and an AML Oceanographic MicroX SV unit for surface sound speed. R/V Substantial utilized an AML MVP30-350 sound speed profiling system. R/V Benthos and R/V Chinook used an AML BaseX2 system for sound speed profiles, while R/V 4-Points utilized an AML-3 LGR. All vessels used the EdgeTech 4205 Sidescan Towfish for sidescan operations. Further details on equipment and software used can be found in the DAPR.

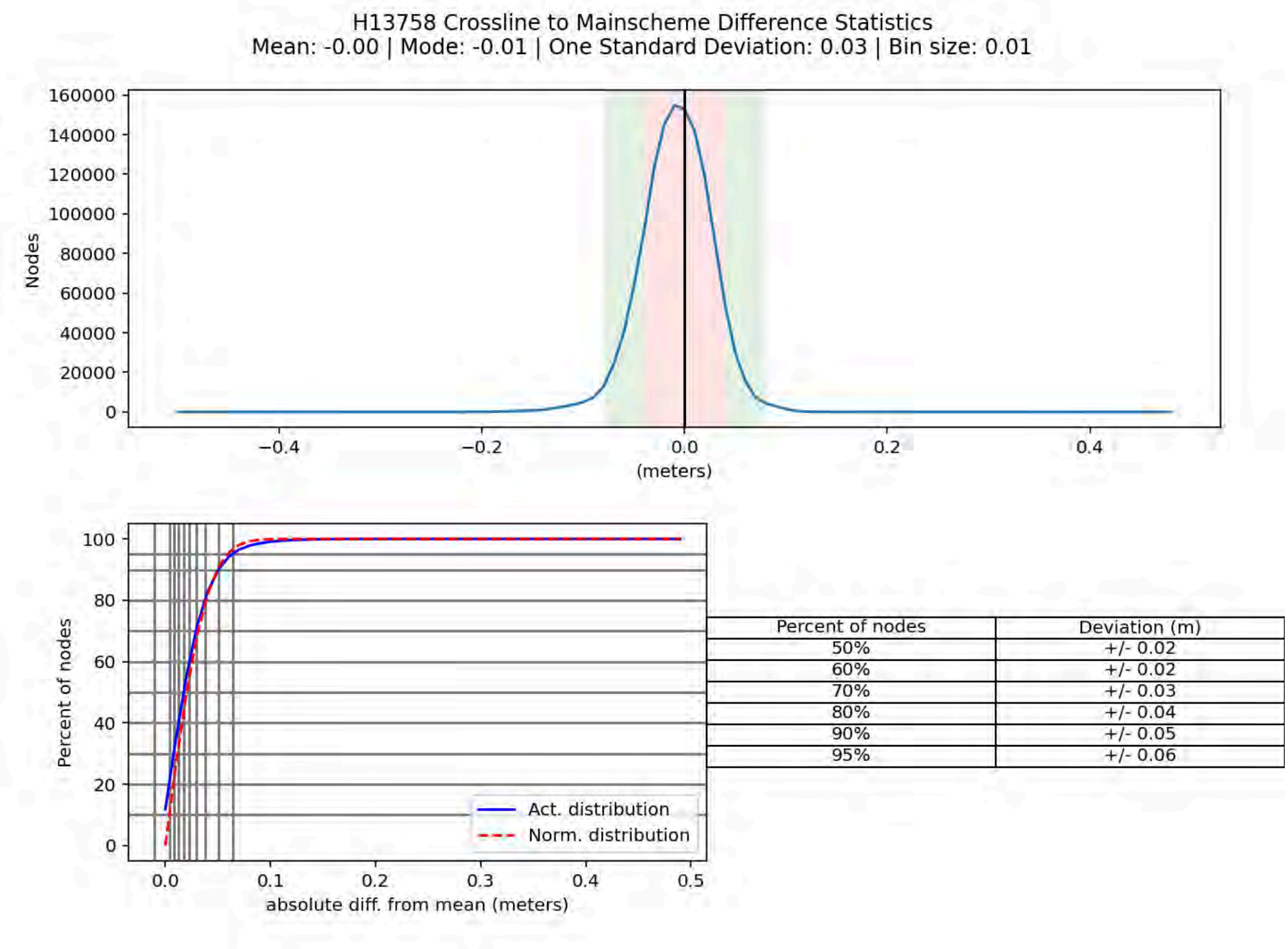
B.2 Quality Control

B.2.1 Crosslines

Multibeam crosslines acquired for H13758 totaled 4.90% of mainscheme acquisition.

H13758 crosslines were collected and analyzed in accordance with section 5.2.4.2 of the HSSD. Crosslines were evaluated in CARIS HIPS with a detailed visual inspection followed by a thorough statistical analysis. To conduct the statistical analysis, a 1 m CUBE surface was generated with strictly mainscheme data and another, separate 1 m CUBE surface was generated with only crossline data. The mainscheme and crossline surfaces were analyzed using the Compare Grids tool in Pydro Explorer, which generated a difference surface and associated statistics. In addition to the direct statistics from the surface differencing, the tool assessed the difference surface statistics and computed the proportion of NOS total allowable vertical uncertainty (TVU) consumed by the mainscheme to crossline differences per surface node.

The statistical results of the difference comparison show 95% of nodes falling within +/- 0.06 m, with a mean difference of 0.00 m (Figure 5). Additionally, at least 95% of the difference surface nodes met or exceeded TVU specifications, as described in section 5.1.3 of the HSSD.



Percent of nodes	Deviation (m)
50%	+/- 0.02
60%	+/- 0.02
70%	+/- 0.03
80%	+/- 0.04
90%	+/- 0.05
95%	+/- 0.06

Figure 5: H13758 crossline to mainscheme difference statistics

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Method	Measured	Zoning
ERS via VDATUM	0.0 meters	0.08 meters

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Measured - XBT	Surface
R/V 4Points	2.00 meters/second	N/A meters/second	N/A meters/second	0.05 meters/second
R/V Benthos	2.00 meters/second	N/A meters/second	N/A meters/second	0.05 meters/second
R/V Chinook	2.00 meters/second	N/A meters/second	N/A meters/second	0.05 meters/second
R/V Substantial	N/A meters/second	2.00 meters/second	N/A meters/second	0.05 meters/second

Table 8: Survey Specific Sound Speed TPU Values.

The finalized CUBE surface was analyzed using the HydrOffice QC Tools Grid QA tool to assure 95% of the surface nodes meet TVU specifications. The results of the Grid QA tool determined that the finalized CUBE surface met or exceeded the TVU specifications, as shown in Figure 6.

The multibeam surface was finalized with the computed uncertainty, derived from a mix of a priori and real-time uncertainty estimates, assigned as the uncertainty value. It should be noted that the uncertainty associated with the SEP model was applied in CARIS as the GPS Sounding Datum uncertainty, and not as Tide Zoning uncertainty. Additional details related to uncertainty methods may be found in the DAPR.

In one area from Substantial day number 076, line 0009_20230317_042022_SU, the uncertainty exceeds the allowable limit. This exceedance was short in duration and did not result in any vertical shifts or misalignment with adjacent data. Though this area exceeds the allowable TVU, the artifact was not widespread and therefore the submitted grids meet the complete coverage requirements set forth in HSSD, with at least 95% of surface nodes meeting the allowable TVU specifications.

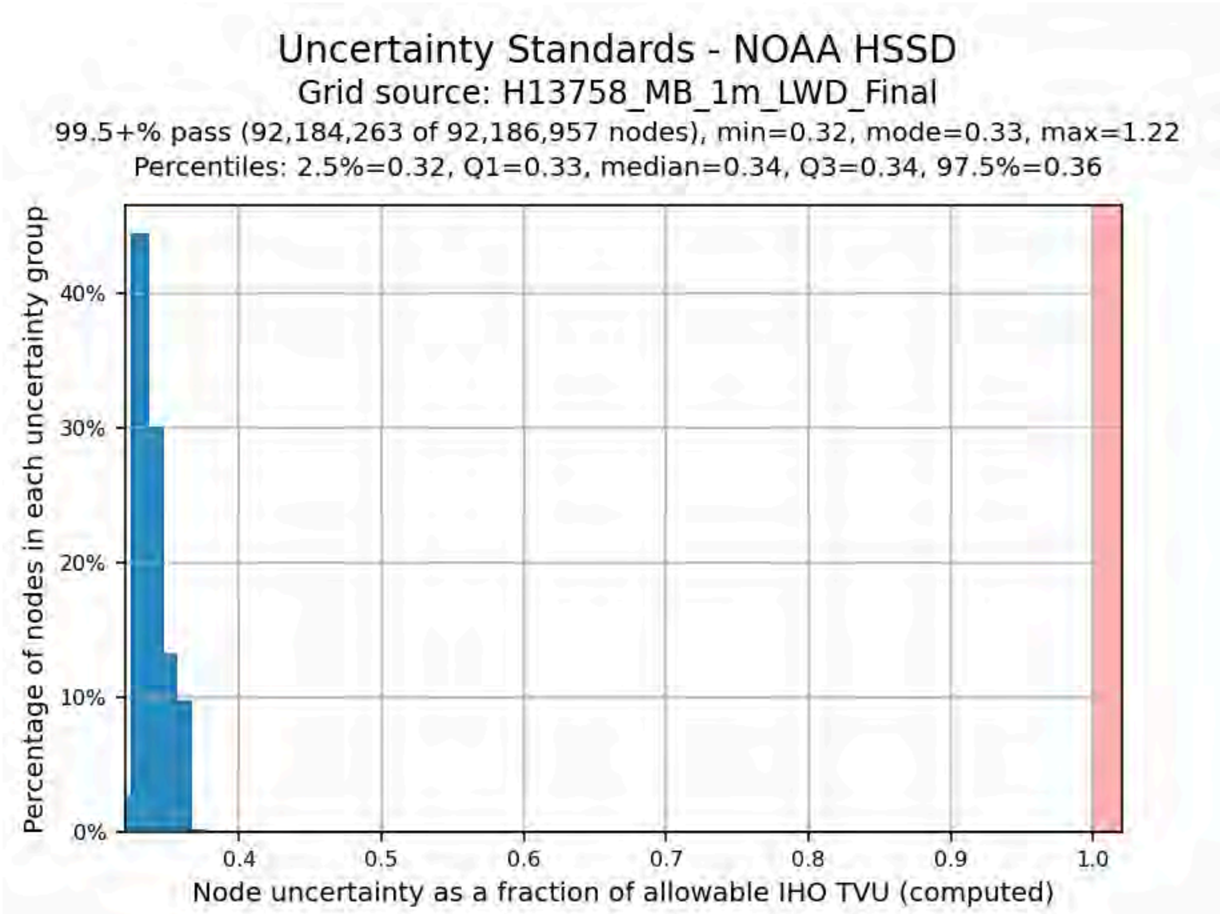


Figure 6: Finalized 1 m CUBE surface TVU statistics for H13758

B.2.3 Junctions

No junctioning surveys were provided for this project (see PI). However, H13758 junctions with H13755, H13760, H13761, H13762, and H13763 (Figure 7). Data overlap between H13758 and the adjacent surveys were attained. To conduct the junction analyses, similar to section B.2.1 of this report, the Pydro Compare Grids tool was utilized. The inputs for this tool were the surfaces for each individual survey. It should be noted for SBES CARIS Uncertainty surfaces the shoal layer was utilized for the analysis. In addition to the statistical results of the junction analyses, the resultant difference surfaces were visually inspected and CARIS HIPS Subset Editor was used to examine overlapping data for consistency, agreement between surveys, and confirming data met TVU specifications.

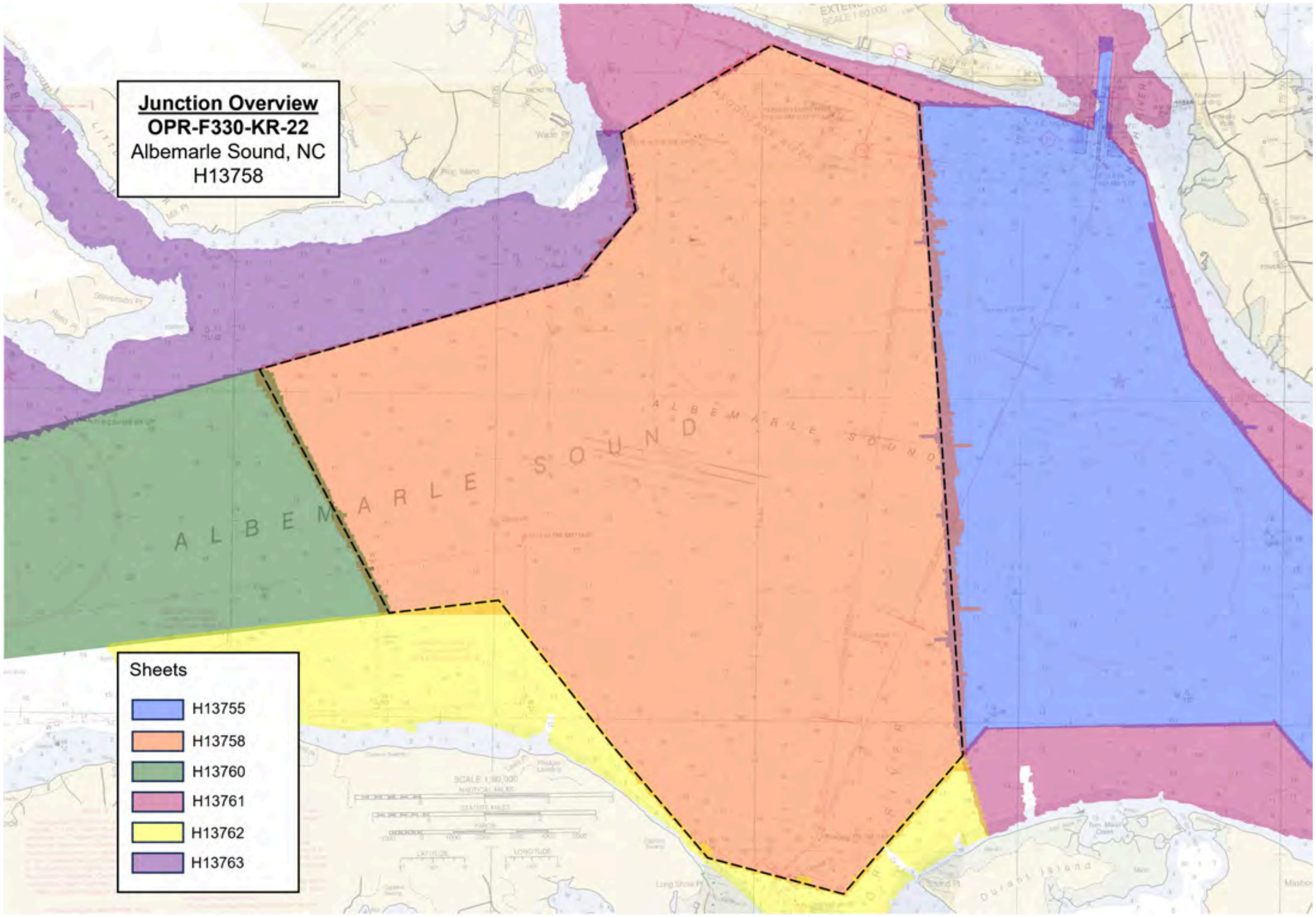


Figure 7: Overview of H13758 junction surveys

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H13755	1:5000	2023	Geodynamics	E
H13760	1:5000	2023	Geodynamics	W
H13761	1:5000	2023	Geodynamics	N
H13762	1:5000	2023	Geodynamics	S
H13763	1:5000	2023	Geodynamics	NW

Table 9: Junctioning Surveys

<u>H13755</u>

The statistical results of the difference comparison show 95% of nodes falling within +/- 0.08 m, with a mean difference of 0.00 m (Figure 8). Additionally, at least 95% of the difference surface nodes met or exceed TVU specifications, as described in section 5.1.3 of the HSSD.

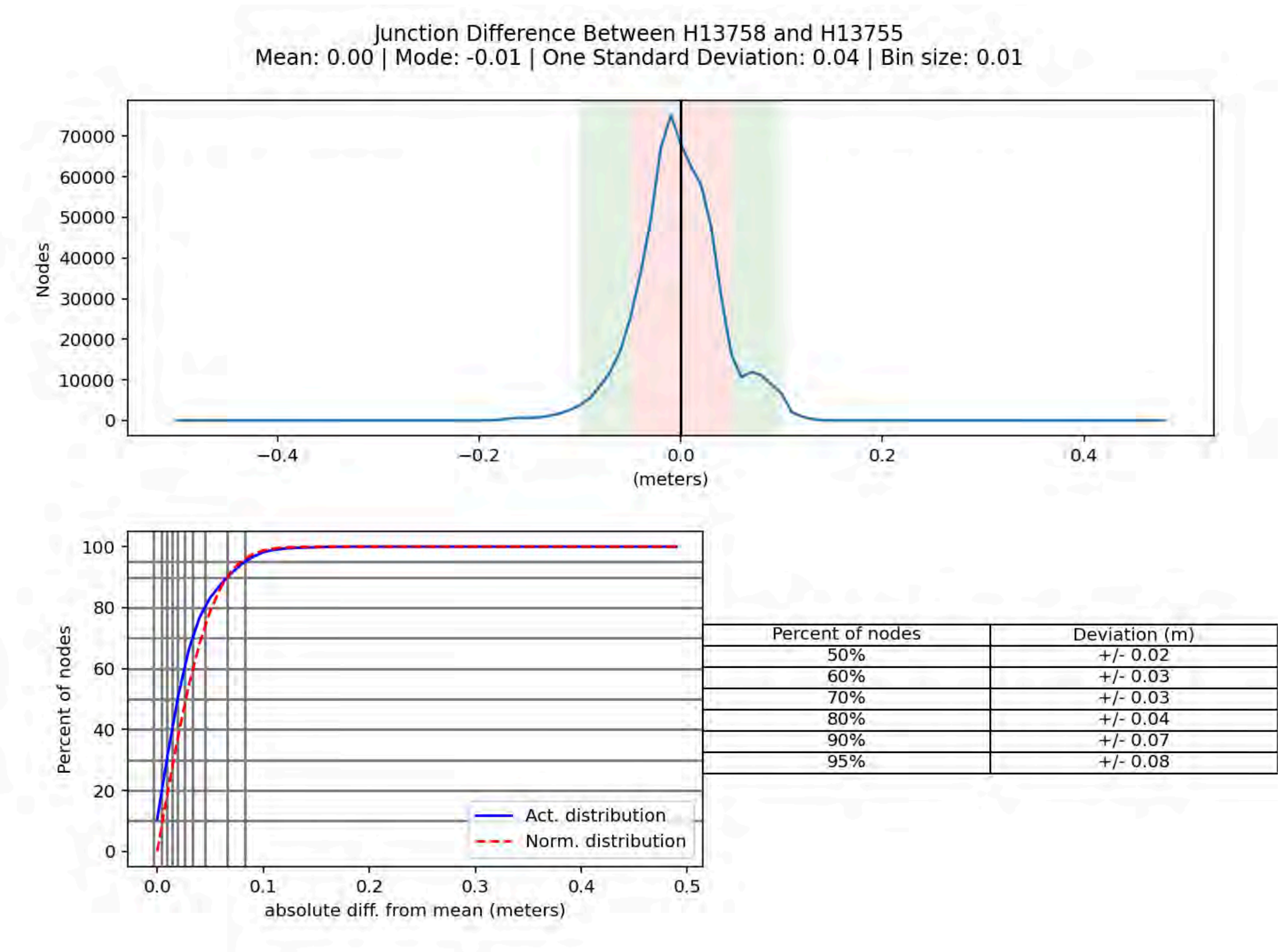
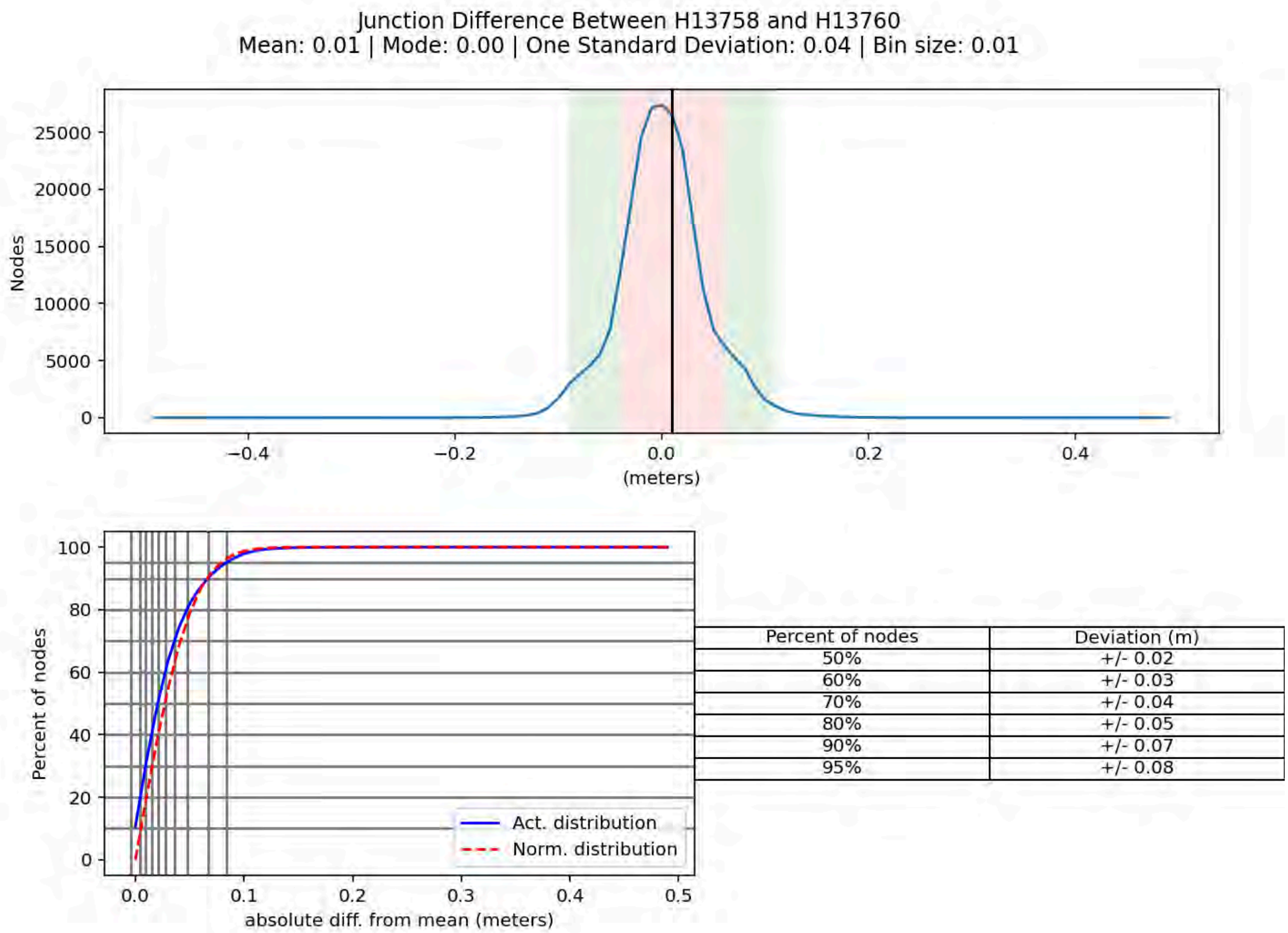


Figure 8: Junction analysis between H13758 and H13755

<u>H13760</u>

The statistical results of the difference comparison show 95% of nodes falling within +/- 0.08 m, with a mean difference of 0.01 m (Figure 9). Additionally, at least 95% of the difference surface nodes met or exceed TVU specifications, as described in section 5.1.3 of the HSSD.

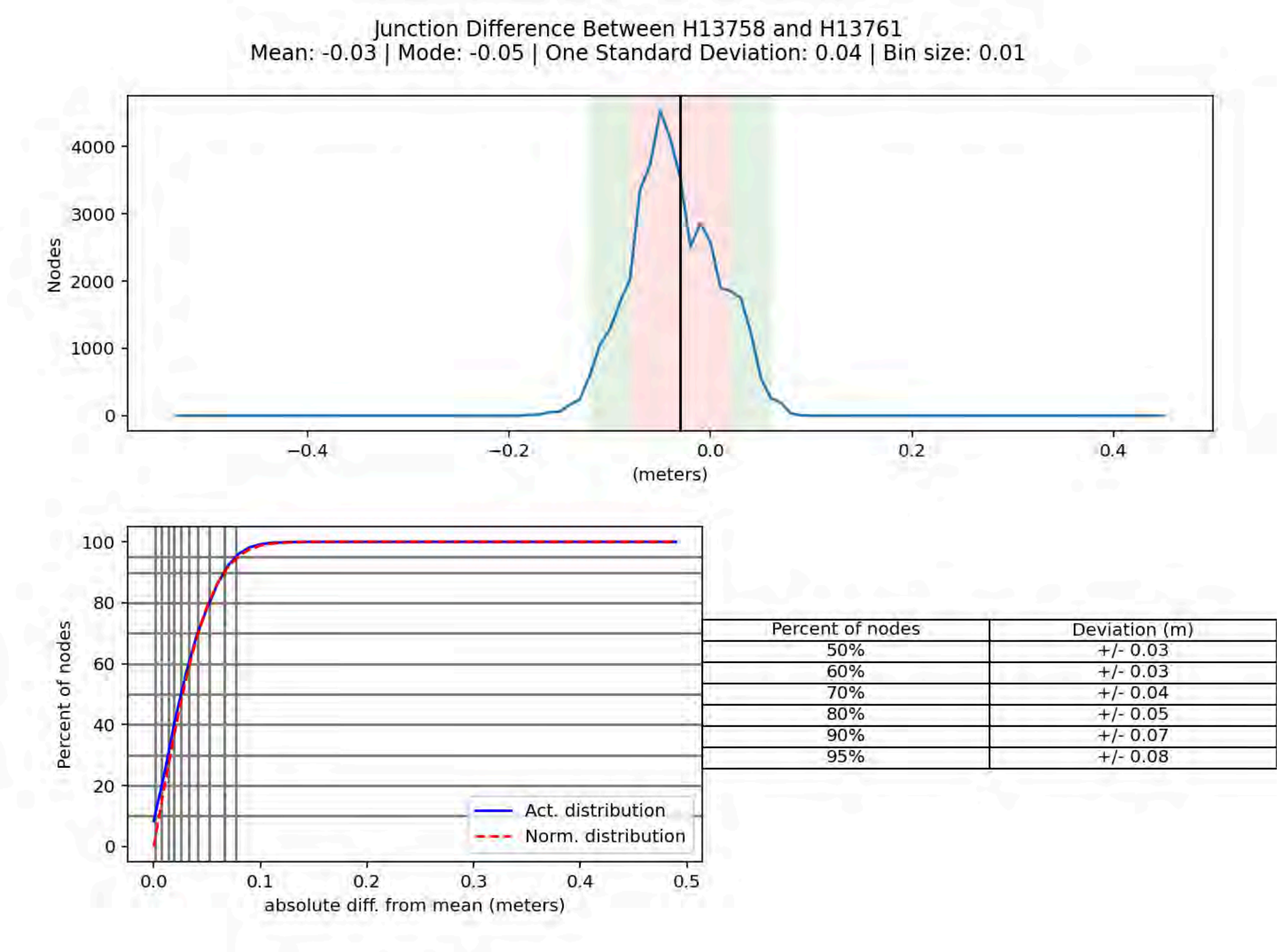


Percent of nodes	Deviation (m)
50%	+/- 0.02
60%	+/- 0.03
70%	+/- 0.04
80%	+/- 0.05
90%	+/- 0.07
95%	+/- 0.08

Figure 9: Junction analysis between H13758 and H13760

<u>H13761</u>

The statistical results of the difference comparison with the H13761 SBES shoal layer show 95% of nodes falling within +/- 0.08 m, with a mean difference of 0.03 m (Figure 10). Additionally, at least 95% of the difference surface nodes met or exceed TVU specifications, as described in section 5.1.3 of the HSSD.



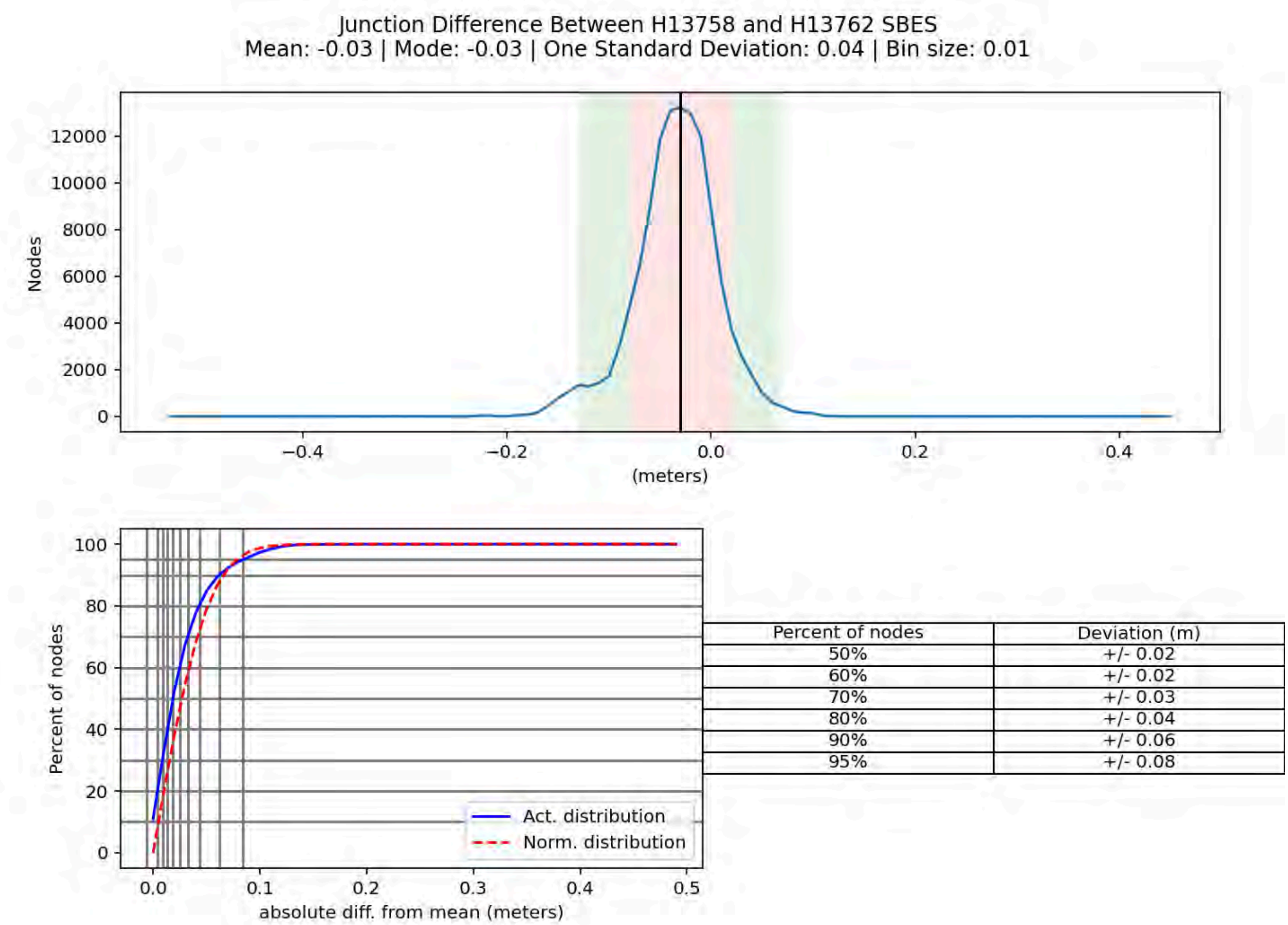
Percent of nodes	Deviation (m)
50%	+/- 0.03
60%	+/- 0.03
70%	+/- 0.04
80%	+/- 0.05
90%	+/- 0.07
95%	+/- 0.08

Figure 10: Junction analysis between H13758 and H13761

<u>H13762</u>

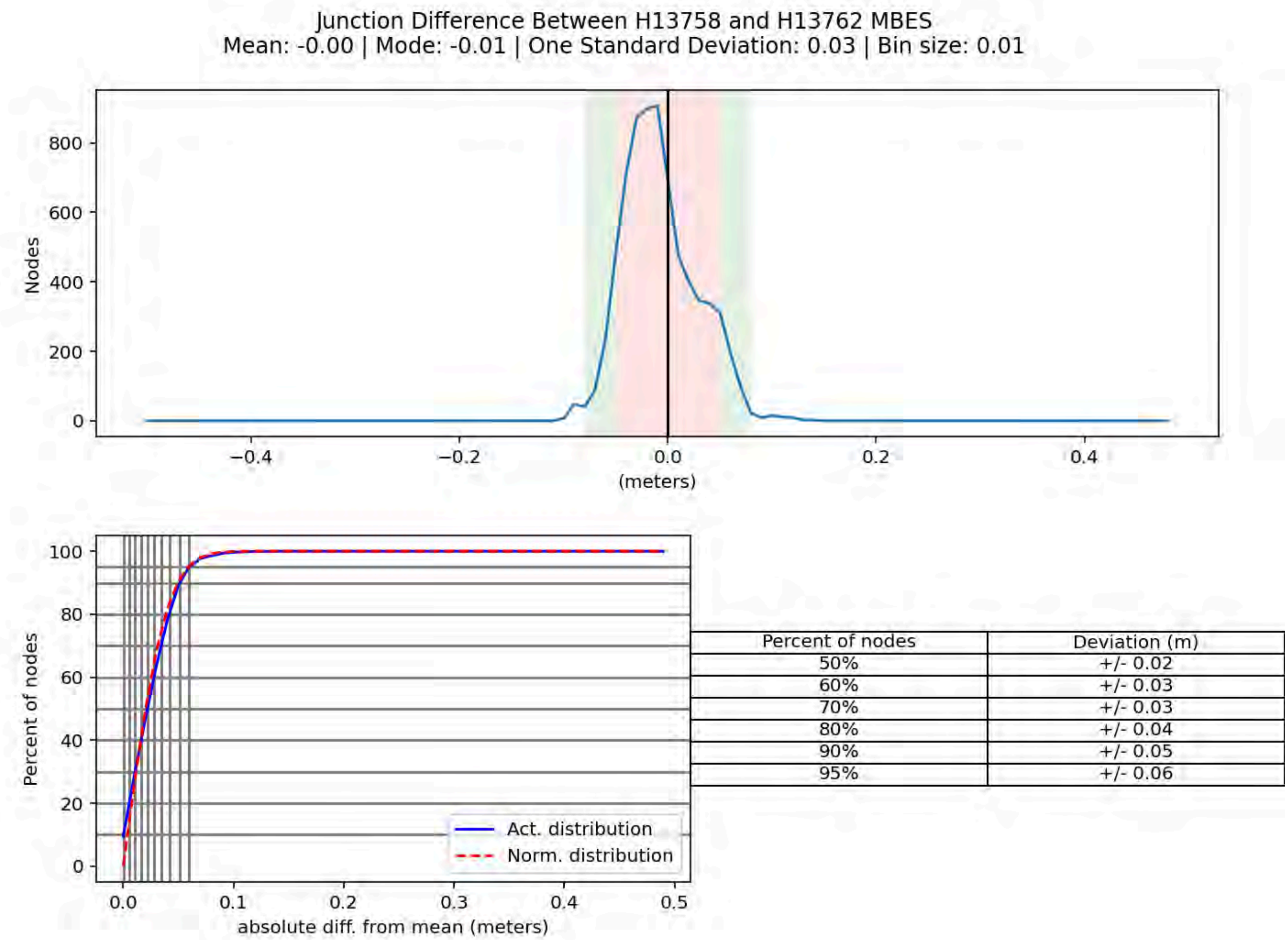
The statistical results of the difference comparison with the H13762 SBES shoal layer show 95% of nodes falling within +/- 0.08 m, with a mean difference of 0.03 m (Figure 11). Additionally, at least 95% of the difference surface nodes met or exceed TVU specifications, as described in section 5.1.3 of the HSSD.

The statistical results of the difference comparison with the H13762 MBES show 95% of nodes falling within +/- 0.06 m, with a mean difference of 0.00 m (Figure 12). Additionally, at least 95% of the difference surface nodes met or exceed TVU specifications, as described in section 5.1.3 of the HSSD.



Percent of nodes	Deviation (m)
50%	+/- 0.02
60%	+/- 0.02
70%	+/- 0.03
80%	+/- 0.04
90%	+/- 0.06
95%	+/- 0.08

Figure 11: Junction analysis between H13758 and H13762 SBES



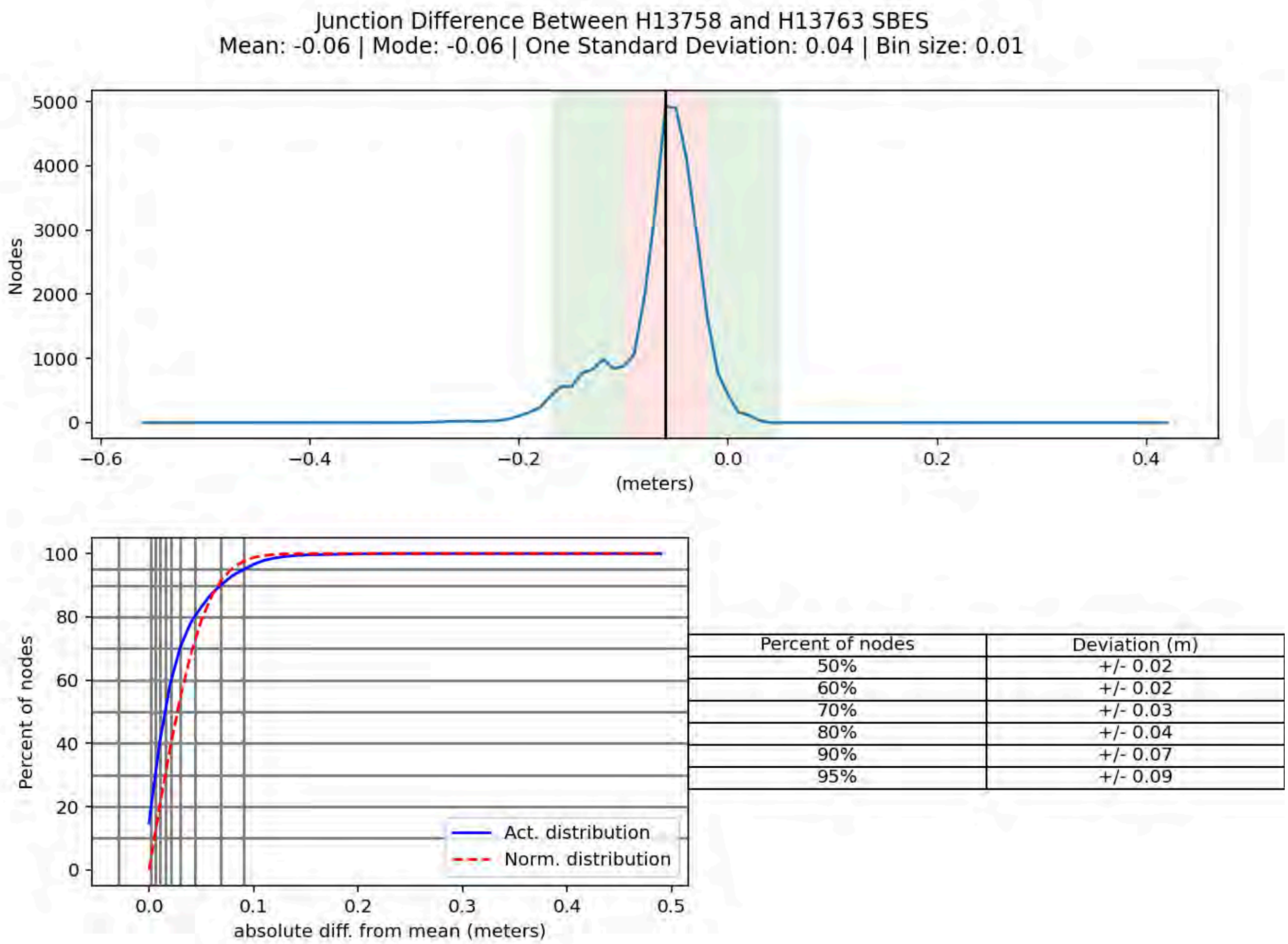
Percent of nodes	Deviation (m)
50%	+/- 0.02
60%	+/- 0.03
70%	+/- 0.03
80%	+/- 0.04
90%	+/- 0.05
95%	+/- 0.06

Figure 12: Junction analysis between H13758 and H13762 MBES

<u>H13763</u>

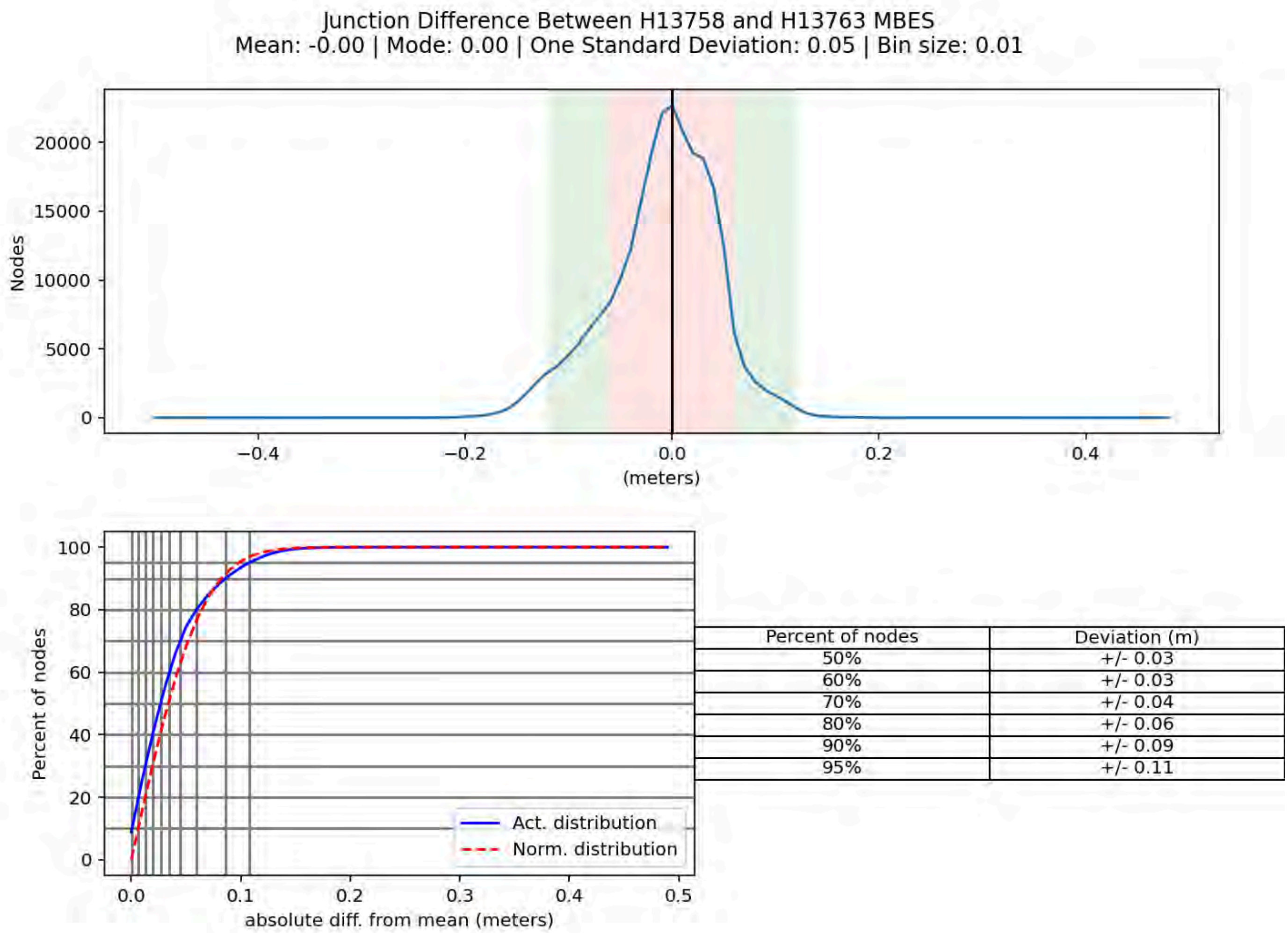
The statistical results of the difference comparison with the H13763 SBES shoal layer show 95% of nodes falling within +/- 0.09 m, with a mean difference of 0.06 m (Figure 13). Additionally, at least 95% of the difference surface nodes met or exceed TVU specifications, as described in section 5.1.3 of the HSSD.

The statistical results of the difference comparison with the H13763 MBES show 95% of nodes falling within +/- 0.11 m, with a mean difference of 0.00 m (Figure 14). Additionally, at least 95% of the difference surface nodes met or exceed TVU specifications, as described in section 5.1.3 of the HSSD.



Percent of nodes	Deviation (m)
50%	+/- 0.02
60%	+/- 0.02
70%	+/- 0.03
80%	+/- 0.04
90%	+/- 0.07
95%	+/- 0.09

Figure 13: Junction analysis between H13758 and H13763 SBES



Percent of nodes	Deviation (m)
50%	+/- 0.03
60%	+/- 0.03
70%	+/- 0.04
80%	+/- 0.06
90%	+/- 0.09
95%	+/- 0.11

Figure 14: Junction analysis between H13758 and H13763 MBES

B.2.4 Sonar QC Checks

Sonar system quality control checks were conducted as detailed in the quality control section of the DAPR.

B.2.5 Equipment Effectiveness

Environmental influences affecting Sidescan imagery

Throughout the duration of the survey, side scan acquisition frequently encountered environmental conditions which affected portions of the swath which would hinder the selection of contacts in the affected regions. The persistent challenging environmental influences were communicated with NOAA HSD OPS in the field and was additionally discussed with AHB prior to sheet submission (see project correspondence). These environmental conditions included numerous bait balls (biologic organisms suspended within the water column), vessel prop wash, and effects from water column stratification.

The affected portions of side scan imagery which would be considered a holiday due to environmental effects were identified and reacquired with either side scan or multibeam bathymetry to meet the complete coverage requirements. The SSS lines that were reacquired frequently encountered similar environmental influences, and the final mosaic has been layered as best as possible to minimize the portrayal of artifacts. The side scan sonar mosaics are not free from environmental influences, but multiple methods were taken to ensure complete coverage was achieved and side scan sonar imagery was sufficient to identify a 1m x 1m x 1m target.

More details on the methods used to ensure complete coverage, assess side scan sonar image quality, and clarifications on the final mosaics can be found in the DAPR and were additionally discussed in the pre-submission meeting with AHB (see project correspondence).

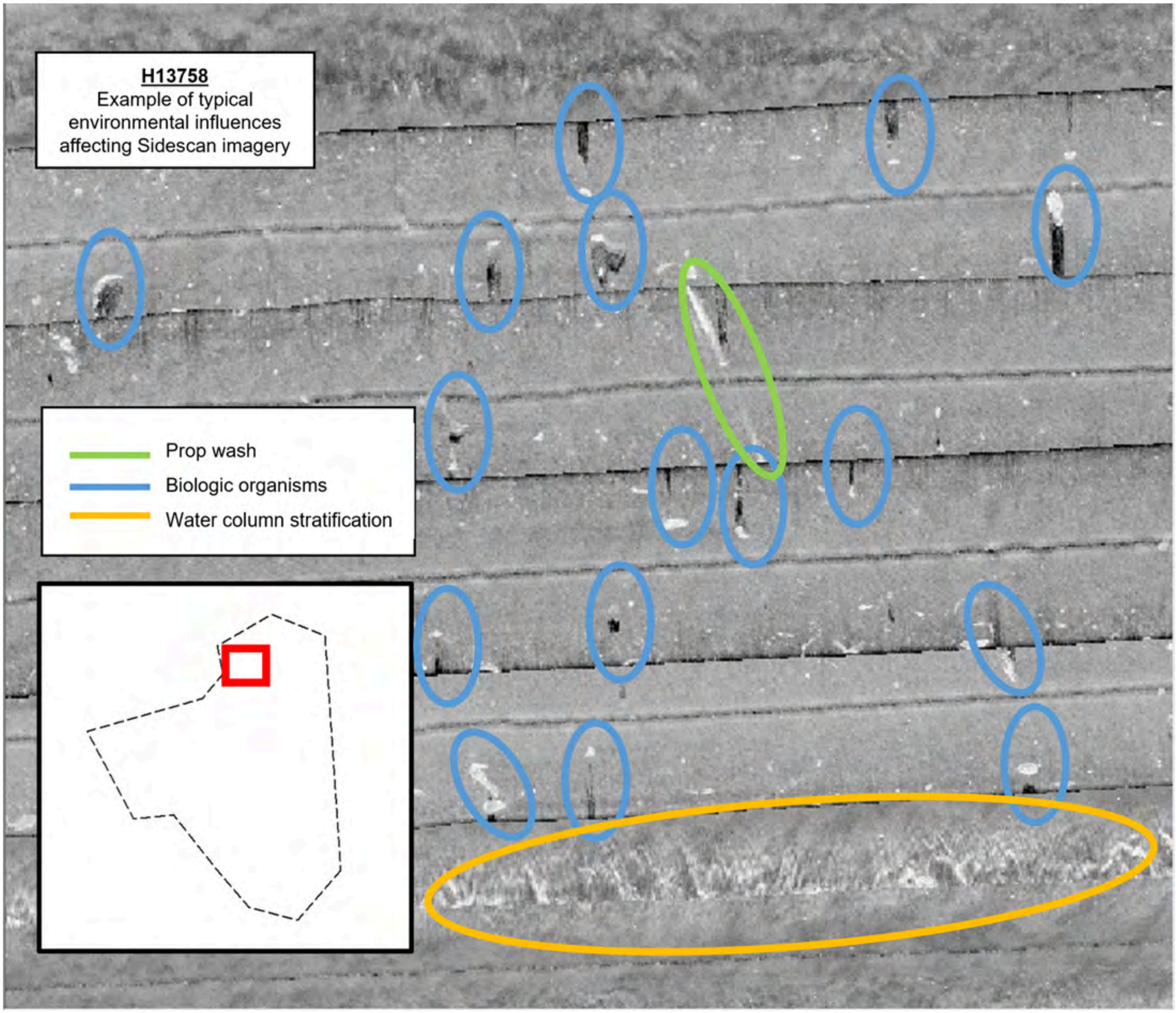


Figure 15: Example of environmental influences affecting SSS imagery which were persistent throughout the survey area

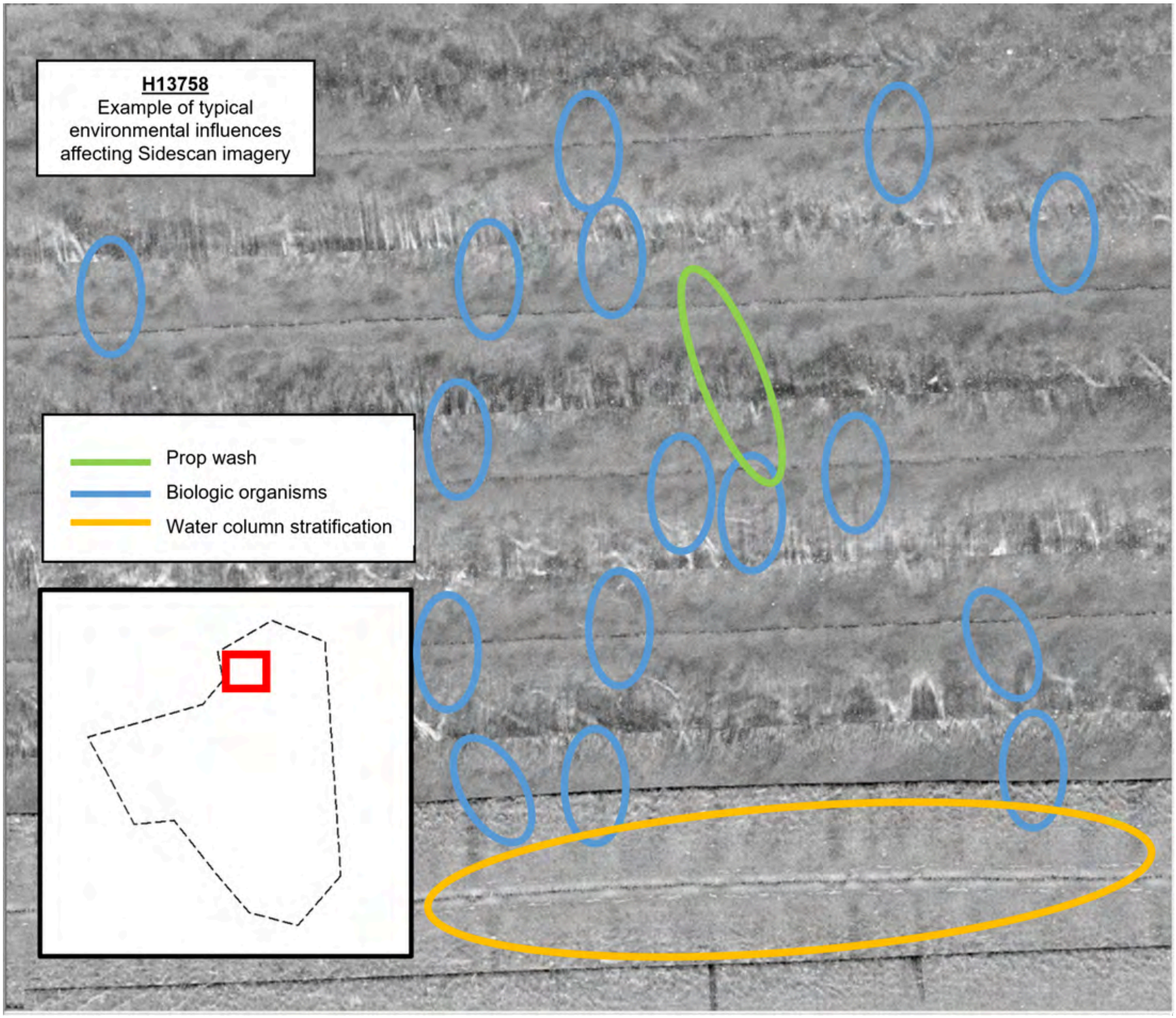


Figure 16: Example of the lines reacquired as infill for the environmental influences as shown above in figure 15

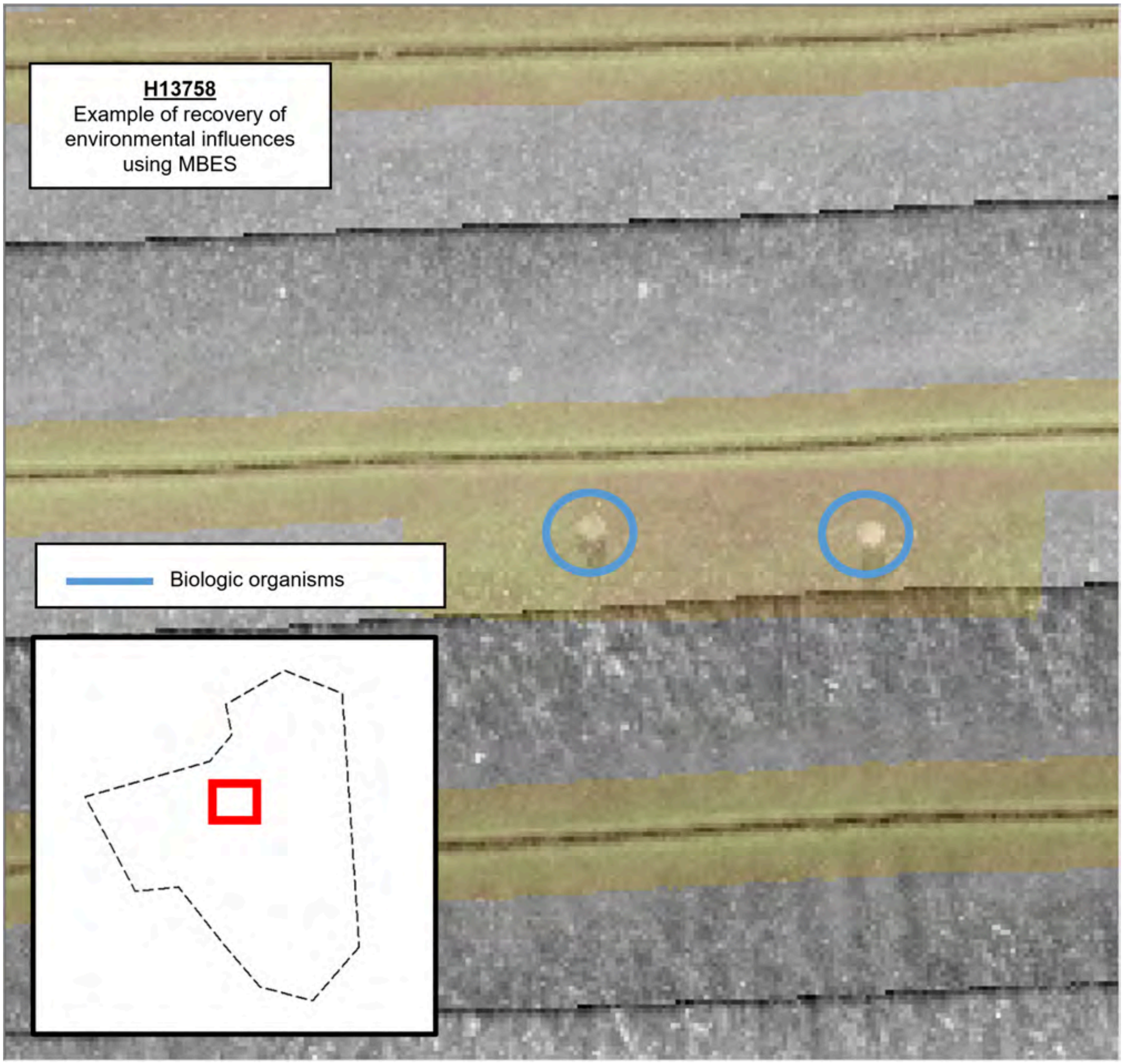


Figure 17: Holidays in the SSS imagery due to the presence of environmental influences were often addressed with complete coverage MBES

Deviation from Sidescan Towfish Altitude Requirement

Side scan towfish altitude reports were generated from all side scan navigation data in SonarWiz and examined to ensure compliance with the adjusted altitude specifications as outlined in the PI. Even with the allowable towfish altitude adjusted to 4-20% of the range scale in use (<8m of water depth), occasional deviations were identified. Any side scan lines which did not adhere to the adjusted altitude specifications were identified and the associated .tif images were re-exported from SonarWiz at a range scale which reduced the effective horizontal range to achieve compliance with the towfish altitude requirements.

Recoveries were then completed as necessary. Approval of the .tif trimming method of addressing deviations from the towfish altitude requirements (as outlined in the PI), can be found in project correspondence.

The challenges encountered while adhering to altitude specifications in very shallow water were communicated to NOAA HSD OPS, and as a result in depths of 2-3.5 m, where a narrow range scale is used (25 m), Geodynamics received guidance for allowance of operating the SSS towfish at an adjusted 3% of the range scale. In addition, Geodynamics was allowed to accept SSS data without trimming the effective imagery range scale for brief periods of altitude exceedances as long as altitude did not get lower than 3% of the range scale and the hydrographer believed imagery met coverage requirements.

Communication and approval of deviations from the towfish height requirements as outlined in the PI, can be found in the project correspondence. Additionally, please see the DAPR for more information on side scan altitude quality control methods as well as more information on side scan .tif trimming.

Multibeam echosounder ping drops

On very rare occasion, it was observed that the multibeam echosounder would experience a "ping drop" issue which resulted in unexpectedly missing ping records, which were not observed by the survey vessel at the time of acquisition. An example of these ping drops are shown below in Figure 18. Any holidays in the resultant 1 meter resolution MBES surface were identified and reacquired, and no holidays resulting from these few and intermittent issues remain in the final delivered surfaces.

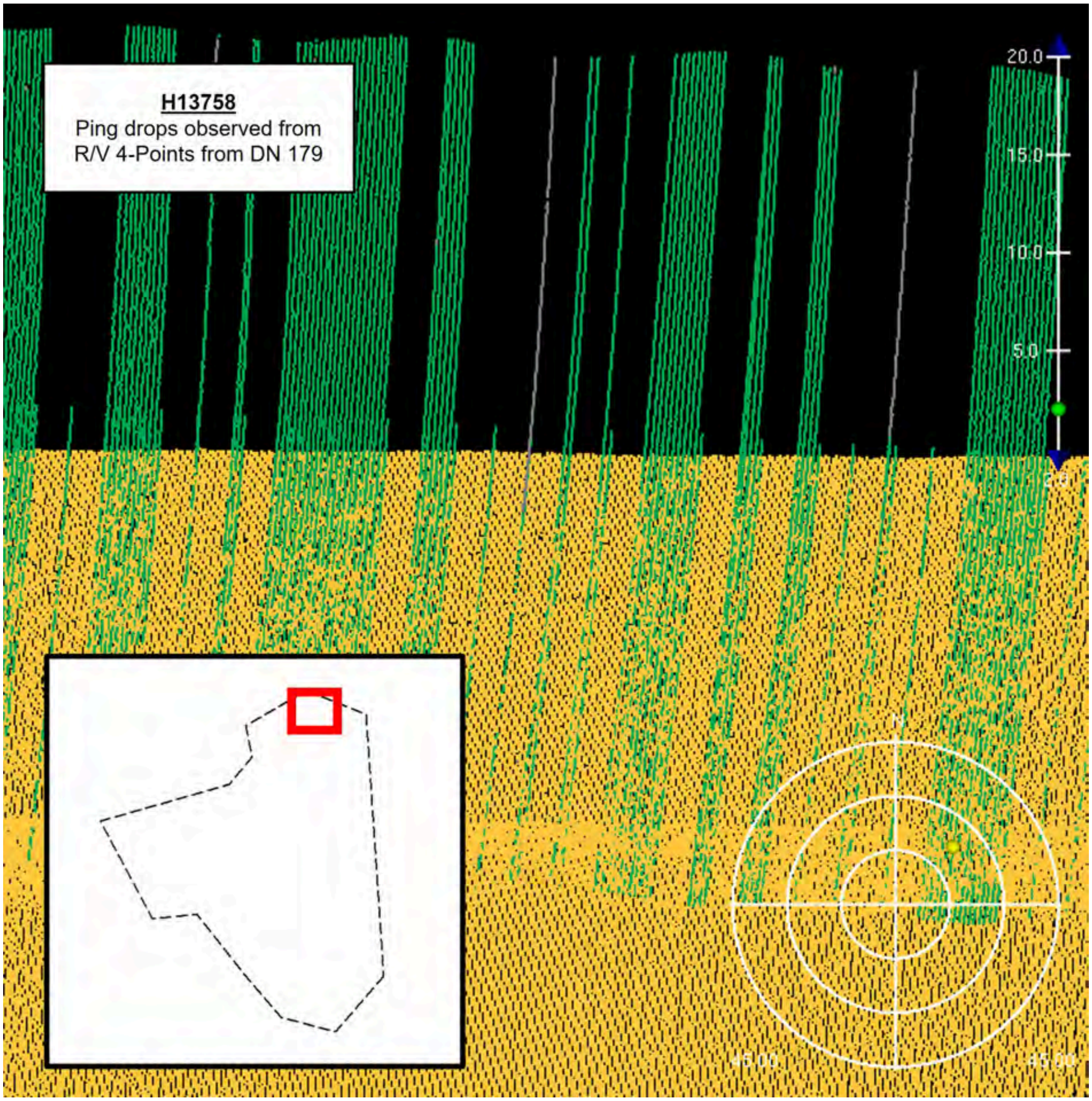


Figure 18: Example of MBES ping drops observed from R/V 4-Points on DN 179

Lack of Delayed Heave Records in Positioning Data

An issue where delayed heave was not recorded, was identified in one line of multibeam data from R/V Substantial on DN 078 (0002_20230319_004620_SU). The portion of this line for which delayed heave is missing shows up in the processed .hips file as a geo-referenced trackline, however no soundings from that period exist in Caris, and thus there was no effect to the bathymetric surface. The section of line with missing data was reacquired on a later date, and did not appear elsewhere in H13758.

Recreational Fishing Gear

Throughout the survey area, crab pots and other types of recreational fishing gear were observed or identified within the data, as seen in Figure 19. Particular attention was taken to avoid gear interactions and promote the safety of vessels and equipment, and at times defined the survey limits. Crab pots were identified within the sidescan sonar imagery or multibeam data, and were most often found to be of dimensions that did not warrant investigation. These objects were rejected from the multibeam data if they caused the surface to be pulled past TVU, but were otherwise not rejected. Please see the DAPR and section D.1.4 of this report for more information on fishing stakes.

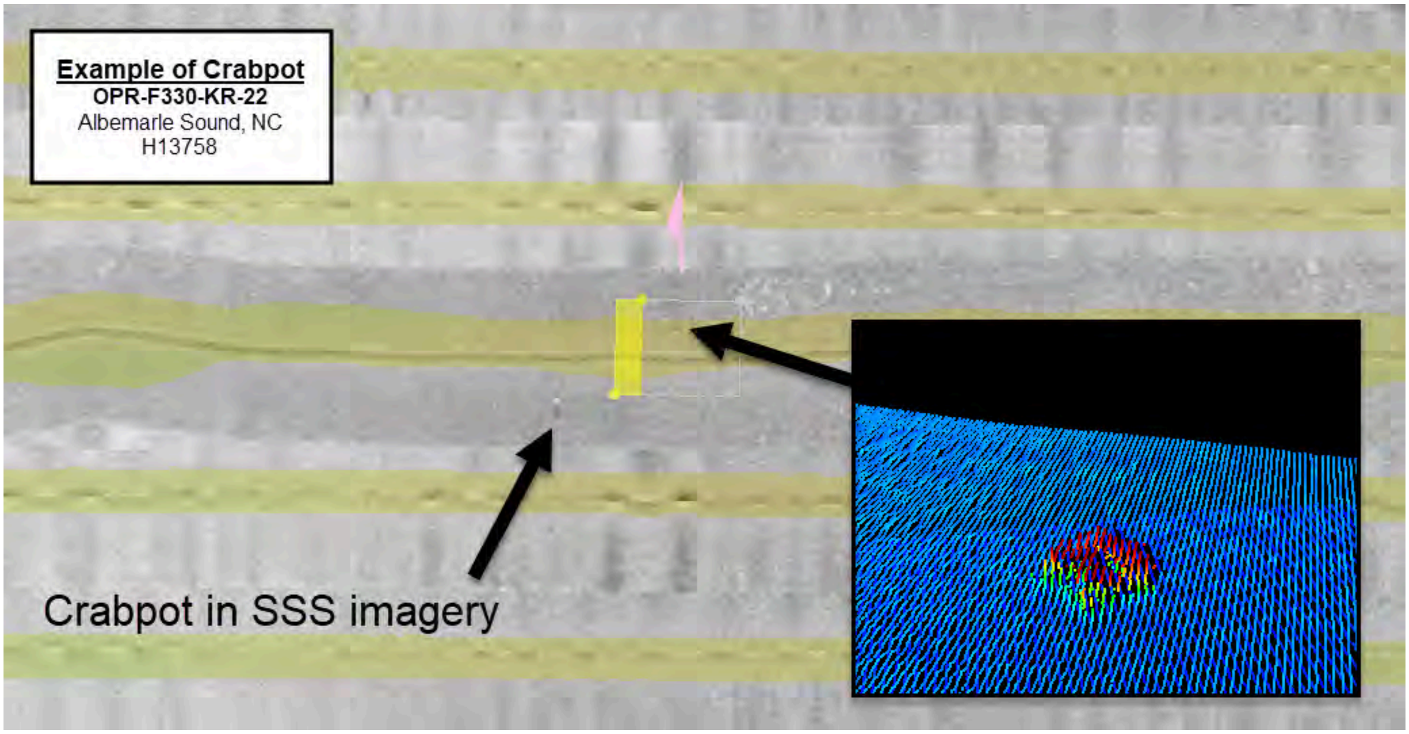


Figure 19: An example of a crab pot in SSS and multibeam data

B.2.6 Factors Affecting Soundings

There were no other factors that affected corrections to soundings.

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: Sound speed casts were acquired at least once every four hours. Casts were often conducted more frequently than this time interval because of the dynamic water properties in the survey area. Additionally, the R/V Substantial utilized an MVP onboard which allowed for a higher frequency of casts.

Surface sound speed was compared in real-time to the sound speed profile. When the comparison differed by more than 2 m/s, a new sound speed profile was acquired. Additionally, Hypack and Kongsberg SIS provided a real-time visual assessment of data quality (bathymetric grids, swath views) aiding the hydrographer in determining when a new cast was required.

For more detailed information on sound speed methods, refer to the DAPR.

B.2.8 Coverage Equipment and Methods

All equipment and survey methods were used as detailed in the DAPR.

B.2.9 Density

The finalized CUBE surface were analyzed using HydrOffice QC Tools Grid QA tool to assure data met the required density specifications. Density requirements were achieved for the finalized surface in H13758 with at least 95% of the surface nodes (Figure 20) containing at least five or more soundings, exceeding the specifications required by section 5.2.2.3 of the HSSD.

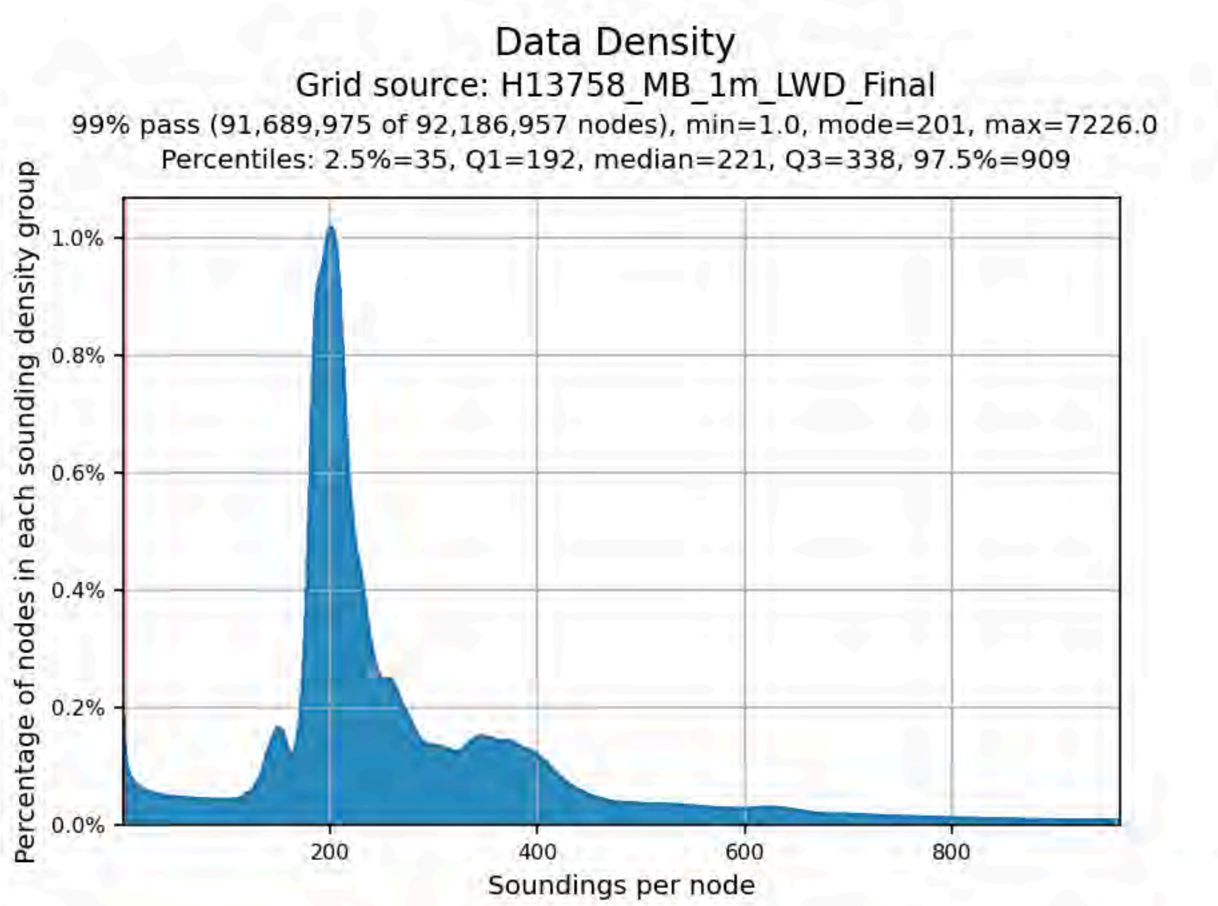


Figure 20: Finalized 1 m CUBE surface density statistics for H13758

B.2.10 Flier Finder

In addition to a visual inspection, the CUBE surface was analyzed using HydrOffice QC Tools Flier Finder tool to assure data does not contain fliers (anomalous data as defined by QC Tools flier finding algorithms #2-5). While the Flier Finder tool flags surface fliers meeting a set criteria, it will also flag real surface features that meet the same criteria. Spurious soundings flagged by Flier Finder were cleaned until either no fliers remained or the remaining flagged fliers were deemed valid aspects of the surface.

B.2.11 Holidays

All CUBE surfaces were analyzed using HydrOffice QC Tools Holiday Finder to determine if the surfaces contained holidays, as described in section 5.2.2.3 of the HSSD. The tool scanned the CUBE surfaces, identifying any holidays, and generated an S-57 file to illustrate the locations of holidays.

Another method of holiday evaluation was to visually pan the CUBE surfaces to identify holidays. The hydrographer would often alter the surface display (color ranges, symbology, shading) to help aid the hydrographer in identifying coverage gaps. The results reflected the same outcome as the tool. The primary source of data gaps in the multibeam surface were the result of dense bait balls which were additionally identified in the side scan imagery. These erroneous soundings were rejected by the hydrographer, were recovered with additional multibeam data, and are not reflected in the final surface.

The side scan mosaic was extensively reviewed for coverage gaps or environmental influences which would prevent the detection of a 1m x 1m x 1m object. When identified, additional SSS or MBES data were acquired to meet complete coverage requirements.

Additional information on data quality management can be found in the DAPR.

B.3 Echo Sounding Corrections

B.3.1 Corrections to Echo Soundings

All data reduction procedures conform to those detailed in the DAPR.

B.3.2 Calibrations

All sounding systems were calibrated as detailed in the DAPR.

B.4 Backscatter

Raw backscatter data were collected and stored within the .ALL files. Backscatter data were processed and reviewed for quality assurance in QPS FMGT. In accordance with the HSSD, GSFs and backscatter mosaics were exported from FMGT. Hydrographers in the field monitored backscatter intensities in real-time and made efforts to collect quality backscatter without hindering bathymetric data quality. Refer to the DAPR for more information on backscatter data acquisition and processing procedures.

B.5 Data Processing

B.5.1 Primary Data Processing Software

The following software program was the primary program used for bathymetric data processing:

Manufacturer	Name	Version
CARIS	HIPS and SIPS	11.4.20
CARIS	HIPS and SIPS	11.4.22
CARIS	HIPS and SIPS	11.4.26

Table 10: Primary bathymetric data processing software

The following software program was the primary program used for imagery data processing:

Manufacturer	Name	Version
QPS	FMGT	7.10.1
Chesapeak Technologies	SonarWiz 7	7.10.02

Table 11: Primary imagery data processing software

The following Feature Object Catalog was used: NOAA Profile Version 2023.

It should be noted the multibeam CUBE surface purpose is for SSS nadir gap coverage as well as fill and investigations. See DAPR for more details on the utilization of MBES.

B.5.2 Surfaces

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

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
H13758_MB_1m_LWD_Final	CARIS Raster Surface (CUBE)	1 meters	1.86 meters - 6.25 meters	NOAA_1m	Complete MBES
H13758_MB_1m_LWD	CARIS Raster Surface (CUBE)	1 meters	1.86 meters - 6.25 meters	NOAA_1m	Complete MBES
H13758_SSSAB_1m_540kHz_1of2	SSS Mosaic	1 meters	-	N/A	100% SSS
H13758_SSSAB_1m_540kHz_2of2	SSS Mosaic	1 meters	-	N/A	200% SSS

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
H13758_MBAB_2m_4Points_300kHz_1of1	MB Backscatter Mosaic	2 meters	-	N/A	Complete MBES
H13758_MBAB_2m_Benthos_300kHz_1of1	MB Backscatter Mosaic	2 meters	-	N/A	Complete MBES
H13758_MBAB_2m_Chinook_300kHz_1of1	MB Backscatter Mosaic	2 meters	-	N/A	Complete MBES
H13758_MBAB_2m_Substantial_300kHz_1of1	MB Backscatter Mosaic	2 meters	-	N/A	Complete MBES

Table 12: Submitted Surfaces

"H13758_SSSAB_1m_540kHz_1of2" represents the 100% complete coverage of the mainscheme acquisition sheetwide, while "H13758_SSSAB_1m_540kHz_2of2" is the 200% coverage required for feature disproval.

All surfaces submitted are in compliance with the complete coverage requirements per section 5.2.2.3 Option B of the HSSD and the PI.

In addition to the surfaces listed above, interpolated grids were generated and delivered in accordance with PI and guidance from NOAA HSD OPS. These additional grids are for the National Water Center deliverable and reflect _NAVD88 in their respective filenames. Reference the DAPR section C.1.4 for more information on interpolation and gridding methods, and the project correspondence for more information on National Water Center deliverables.

B.5.3 Designated Soundings

H13758 contains 24 designated soundings in accordance with sections 5.2.1.2.3 and 7.4 of the HSSD. These designated soundings were created to facilitate feature management and best represent the least depths of features in the Final Feature File (FFF). One exception to this includes one designated sounding selected over what is believed to be submerged debris within 5 m of a new obstruction observed above water (Unique ID: H13758_DTON_07). This designated sounding was included to ensure the grid represents this shoal feature but was not included as a new feature. In the finalized CUBE surfaces, the CARIS HIPS Apply Designated Soundings function ensured designated sounding depths are retained in the finalized surfaces.

C. Vertical and Horizontal Control

Additional information discussing the vertical or horizontal control for this survey can be found in the accompanying DAPR.

C.1 Vertical Control

The vertical datum for this project is Low Water Datum.

ERS Datum Transformation

The following ellipsoid-to-chart vertical datum transformation was used:

Method	Ellipsoid to Chart Datum Separation File
ERS via VDATUM	Albemarle_Sound_NAD83-LWD(LMSLxGeoid20B-0.5ft)_m.csar

Table 13: ERS method and SEP file

Real-time positional data were corrected with G2+ Global Navigation Satellite System (GNSS) satellite corrections provided by the Fugro Marinestar Satellite-Based Augmentation System (SBAS). To improve the accuracy of the real-time data, real-time position data were post-processed using Applanix POSPac Mobile Mapping Solution (MMS) software. Trimble CenterPoint RTX correction methods were used to create Smoothed Best Estimate of Trajectory (SBET) files, which were applied to the survey data in CARIS HIPS. For further information regarding processing and application of SBET and SEP files, please reference the DAPR.

C.2 Horizontal Control

The horizontal datum for this project is North American Datum 1983 (2011).

The projection used for this project is Universal Transverse Mercator (UTM) Zone 18.

RTK

Real-time positional data were corrected with G2+ GNSS satellite corrections provided by the Fugro Marinestar SBAS.

D. Results and Recommendations

D.1 Chart Comparison

A detailed visual comparison was performed in CARIS HIPS between H13758 and the ENCs listed in Table 14 of section D.1.1. Sounding layers were generated from the CUBE surfaces and overlaid onto the ENCs to visually assess differences between the surveyed and charted depths.

In addition to a detailed visual inspection, ArcGIS was used to quantify the difference between the extracted ENC sounding layers and the CUBE depth values. All soundings from the ENCs used in the visual chart comparison were downloaded as a shapefile from NOAA's ENC Direct to GIS application, and differenced with the surveyed depths from the 1 m surface in ESRI ArcPro. A statistical analysis of the difference comparison is shown in Figure 21. The surveyed depths from H13758 generally agree with the charted soundings from the largest scale ENCs within the survey area, with a mean difference of -0.48 m (ENC soundings shoaler on average).

Due to the status of the outdated charts and potential risk of excessive bathymetric splits, guidance was provided by NOAA HSD OPS with allowance to omit bathymetric splits when a charted sounding between survey lines was shoal of the surveyed data. Data were reviewed in comparison to the chart but also between surveyed depths, conducting bathymetric splits at hydrographer's discretion. Please see project correspondence and the DAPR for further information on this topic.

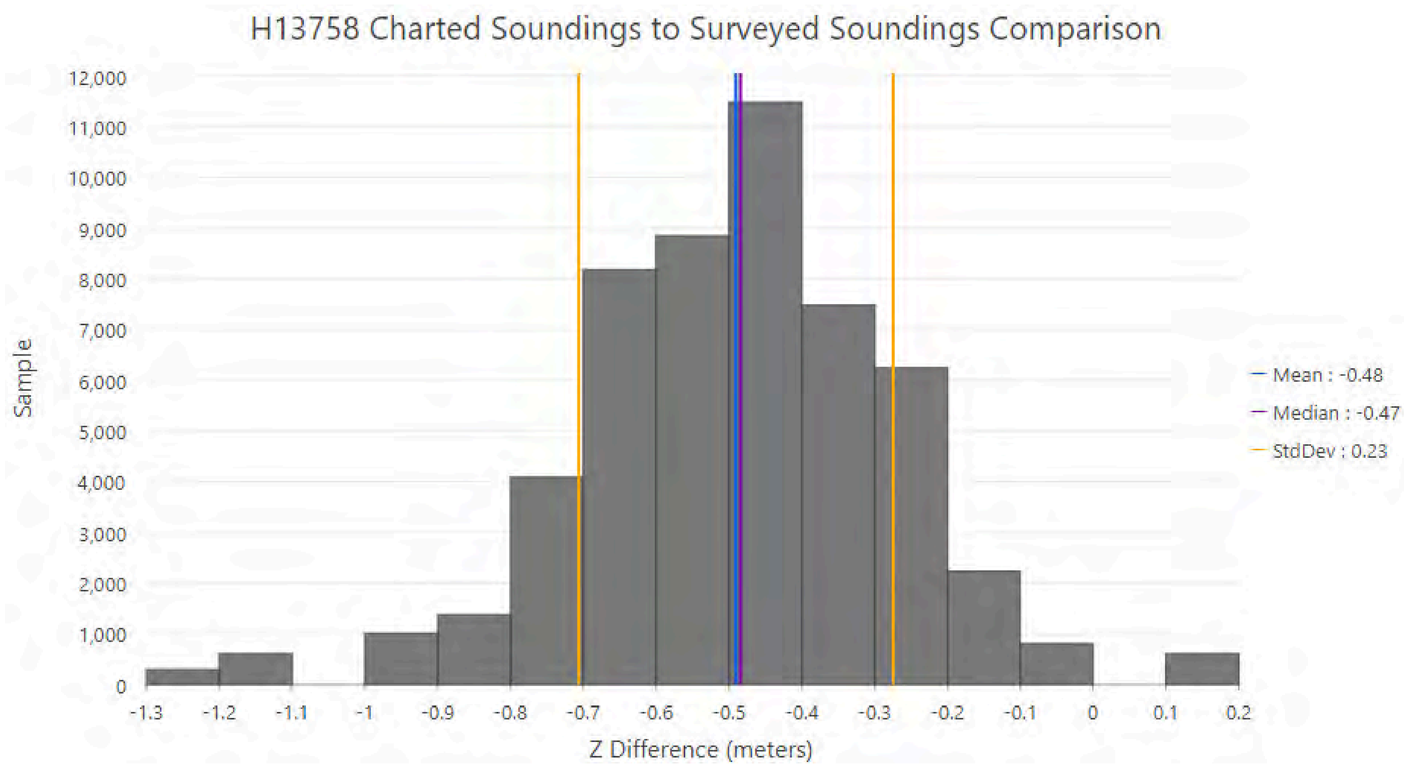


Figure 21: H13758 statistical analysis of surveyed depths to charted soundings

D.1.1 Electronic Navigational Charts

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

ENC	Scale	Edition	Update Application Date	Issue Date
US5NC54M	1:40000	19	03/15/2023	12/11/2023
US4NC53M	1:80000	38	08/29/2023	01/25/2024
US5NC52M	1:40000	16	10/27/2021	02/05/2024

Table 14: Largest Scale ENCs

D.1.2 Shoal and Hazardous Features

No significant shoals were identified to be hazardous in H13758. Seven DTONs were reported and forwarded to MCD, and are added to the FFF appropriately with Special Feature Type as 'DTON'. One submitted and accepted DTON (Unique ID: H13758_ANTI_DTON_02) later became an ANTI-DTON and is addressed appropriately in the FFF (more information below). Refer to the FFF for the remarks and recommendations for each feature. See DR Appendix II Supplemental Records for the submitted DTON reports and related correspondence with the NOAA HSD OPS. Two additional DTONs were submitted to AHB, but were not reported and have been included in the FFF (Unique IDs: 2_039_2 / 2_040_2, and 2_038_1). Please see section D.2.1 of this report for more information regarding those features.

DTON 01 was a wreck with the mast exposed at the surface and was found by visual observation at the time it was reported. The area was later surveyed with side scan sonar, and the imagery was used to position the wreck. The position of this feature changed slightly from the position that was reported and is detailed as such in the FFF.

DTON 02 was submitted as an exposed pile or stump at the surface, however subsequent investigations at a later time found that the stump was no longer visible at the surface. A 150 m disproval was conducted with complete coverage MBES, and no feature was detected. In agreement with NOAA HSD OPS, an ANTI-DTON report was submitted in accordance with section 1.6.4 of the HSSD, and accepted by AHB. This feature is addressed in the FFF (Unique ID: H13758_ANTI_DTON_02) with a description of "Delete". See DR Appendix II Supplemental Records for related correspondence.

D.1.3 Charted Features

Disprovals of charted features within areas that were surveyed with SSS coverage requirements were either conducted or attempted. In agreement with NOAA HSD OPS, all disproval search radii were addressed with consideration of the re-scheme chart scale and were of at least 150 m. When a feature was detected within this radius, completing the disproval was not required and the new feature was addressed as New/Delete. Please reference correspondence for more information on disprovals for this project.

One assigned charted feature (Unique ID: 2_004_2) was identified in the side scan sonar imagery but was not further developed with MBES due to safety considerations. The obstruction is submerged and appropriately charted, positioned between two ATONs that were observed to be on station and serving their intended purpose. This feature has been addressed in the FFF with a description of "Retain".

All assigned charted features within H13758 are detailed in the FFF in accordance with section 7.3 of the HSSD.

D.1.4 Uncharted Features

Two new wrecks (Unique IDs: 2_009_1 and 2_011_1) were identified that did not meet the vertical minimum size requirements for new features at the surveyed depth as defined by sections 7.3.2 and 5.2.2.3 of the HSSD. Due to the potential anthropogenic significance of these features, the uncharted wrecks were included in the FFF to be left up to cartographic discretion.

One feature was identified outside the sheets limits in neighboring sheet, H13755. This feature was investigated and is addressed in the H13755 FFF, in accordance with section 7.3 of the HSSD.

Throughout the survey area, uncharted fishing stakes and pound nets were observed at the surface and identified in the side scan sonar and bathymetric data. In agreement with NOAA HSD OPS, when identified as contacts or within bathymetric data, these features were developed accordingly with MBES to obtain a least depth when safe and practicable, and have been included in the FFF as new obstructions. In the southeast area of the sheet, the sheet limits were not met due safety concerns regarding fishing stakes extending from the shoreline into H13758. This area was reported as a DTON in neighboring sheet H13762, as the majority of the feature was located within H13762. Three submerged fishing stakes that were identified at the end of this area, located in H13758 and were developed with MBES and included in the FFF (Unique ID: 2_041_1).

In agreement with NOAA HSD OPS, heights were not calculated for above water features, and the TECSOU and WATLEV for these features were attributed as "Unknown" and QUASOU as "Depth Unknown" in the FFF. More information on these features can be found in section D.1.2 of this report and related correspondence with NOAA HSD OPS can be found in DR Appendix II Supplemental Records.

With respect to the aforementioned deviations, all new features found within H13758 are detailed in the FFF in accordance with section 7.3 of the HSSD. See DR Appendix II Supplemental Records for related correspondence with NOAA HSD OPS.

D.1.5 Channels

No channels exist within the survey limits.

D.2 Additional Results

D.2.1 Aids to Navigation

One charted ATON, Albemarle Sound Warning Daybeacon A (Unique IDs: 2_039_1 and 2_040_1), was observed to be in a position different than charted. The position of the observed ATON matched the coordinates listed in the USCG Light List, and therefore was not reported as a discrepancy but was submitted to the branch as a DTON though not reported. This daymark and beacon with the observed position has been included in the FFF (Unique IDs: 2_039_2 and 2_040_2) as a new feature.

The charted ATON, Albemarle Sound Light 1AS, was observed to be damaged and replaced with a green can lighted buoy. A discrepancy report was submitted to the USCG, and both features were reported to the branch as DTONs. The damaged ATON was submitted as an obstruction DTON (Unique ID: H13758_DTON_07) and the buoy was not submitted to MCD but is included in the FFF (Unique ID: 2_038_1) as a new feature.

With exception of the aforementioned ATONs, all other ATONs located within H13758 were found to be on station and serving their intended purpose. Please see DR Appendix II Supplemental Records for all related correspondence.

D.2.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.2.3 Bottom Samples

One bottom sample was acquired in accordance with section 7.2.3 of the HSSD and described in the FFF.

D.2.4 Overhead Features

No overhead features exist for this survey.

D.2.5 Submarine Features

No submarine features exist for this survey.

D.2.6 Platforms

No platforms exist for this survey.

D.2.7 Ferry Routes and Terminals

No ferry routes or terminals exist for this survey.

D.2.8 Abnormal Seafloor or Environmental Conditions

No abnormal seafloor or environmental conditions exist for this survey.

D.2.9 Construction and Dredging

No present or planned construction or dredging exist within the survey limits.

D.2.10 New Survey Recommendations

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

D.2.11 ENC Scale Recommendations

No new ENC scales are recommended for this area.

E. Approval Sheet

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 Descriptive 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 Specifications and Deliverables, Field Procedures Manual, 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 with the exception of deficiencies noted in the Descriptive Report.

Report Name	Report Date Sent
Data Acquisition and Processing Report	2024-03-17
Coast Pilot Report	2024-03-08

Approver Name	Approver Title	Approval Date	Signature
Nicholas Damm, CH	Chief of Party	03/17/2024	Nicholas Damm Digitally signed by Nicholas Damm Date: 2024.03.17 17:53:30 -04'00'

F. Table of Acronyms

Acronym	Definition
AHB	Atlantic Hydrographic Branch
AST	Assistant Survey Technician
ATON	Aid to Navigation
AWOIS	Automated Wreck and Obstruction Information System
BAG	Bathymetric Attributed Grid
BASE	Bathymetry Associated with Statistical Error
CO	Commanding Officer
CO-OPS	Center for Operational Products and Services
CORS	Continuously Operating Reference Station
CTD	Conductivity Temperature Depth
CEF	Chart Evaluation File
CSF	Composite Source File
CST	Chief Survey Technician
CUBE	Combined Uncertainty and Bathymetry Estimator
DAPR	Data Acquisition and Processing Report
DGPS	Differential Global Positioning System
DP	Detached Position
DR	Descriptive Report
DTON	Danger to Navigation
ENC	Electronic Navigational Chart
ERS	Ellipsoidal Referenced Survey
ERTDM	Ellipsoidally Referenced Tidal Datum Model
ERZT	Ellipsoidally Referenced Zoned Tides
FFF	Final Feature File
FOO	Field Operations Officer
FPM	Field Procedures Manual
GAMS	GPS Azimuth Measurement Subsystem
GC	Geographic Cell
GPS	Global Positioning System
HIPS	Hydrographic Information Processing System
HSD	Hydrographic Surveys Division

Acronym	Definition
HSSD	Hydrographic Survey Specifications and Deliverables
HSTB	Hydrographic Systems Technology Branch
HSX	Hypack Hysweep File Format
HTD	Hydrographic Surveys Technical Directive
HVCR	Horizontal and Vertical Control Report
HVF	HIPS Vessel File
IHO	International Hydrographic Organization
IMU	Inertial Motion Unit
ITRF	International Terrestrial Reference Frame
LNM	Linear Nautical Miles
MBAB	Multibeam Echosounder Acoustic Backscatter
MCD	Marine Chart Division
MHW	Mean High Water
MLLW	Mean Lower Low Water
NAD 83	North American Datum of 1983
NALL	Navigable Area Limit Line
NTM	Notice to Mariners
NMEA	National Marine Electronics Association
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NRT	Navigation Response Team
NSD	Navigation Services Division
OCS	Office of Coast Survey
OMAO	Office of Marine and Aviation Operations (NOAA)
OPS	Operations Branch
MBES	Multibeam Echosounder
NWLON	National Water Level Observation Network
PDBS	Phase Differencing Bathymetric Sonar
PHB	Pacific Hydrographic Branch
POS/MV	Position and Orientation System for Marine Vessels
PPK	Post Processed Kinematic
PPP	Precise Point Positioning
PPS	Pulse per second

Acronym	Definition
PRF	Project Reference File
PS	Physical Scientist
RNC	Raster Navigational Chart
RTK	Real Time Kinematic
RTX	Real Time Extended
SBES	Singlebeam Echosounder
SBET	Smooth Best Estimate and Trajectory
SNM	Square Nautical Miles
SSS	Side Scan Sonar
SSSAB	Side Scan Sonar Acoustic Backscatter
ST	Survey Technician
SVP	Sound Velocity Profiler
TCARI	Tidal Constituent And Residual Interpolation
TPU	Total Propagated Uncertainty
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
UTM	Universal Transverse Mercator
XO	Executive Officer
ZDF	Zone Definition File