H13762

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H13762

LOCALITY

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

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	**H13762**

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:	**Alligator River**
Scale:	**5000**
Dates of Survey:	**02/24/2023 to 10/24/2023**
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 Singlebeam 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 H13762

Project: OPR-F330-KR-22

Locality: Albemarle Sound

Sublocality: Alligator River

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 H13762 located in the Alligator River. Within H13762, 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° 1' 46.78" N 76° 12' 16.41" W	35° 38' 47.05" N 75° 55' 12.03" W

Table 1: Survey Limits

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

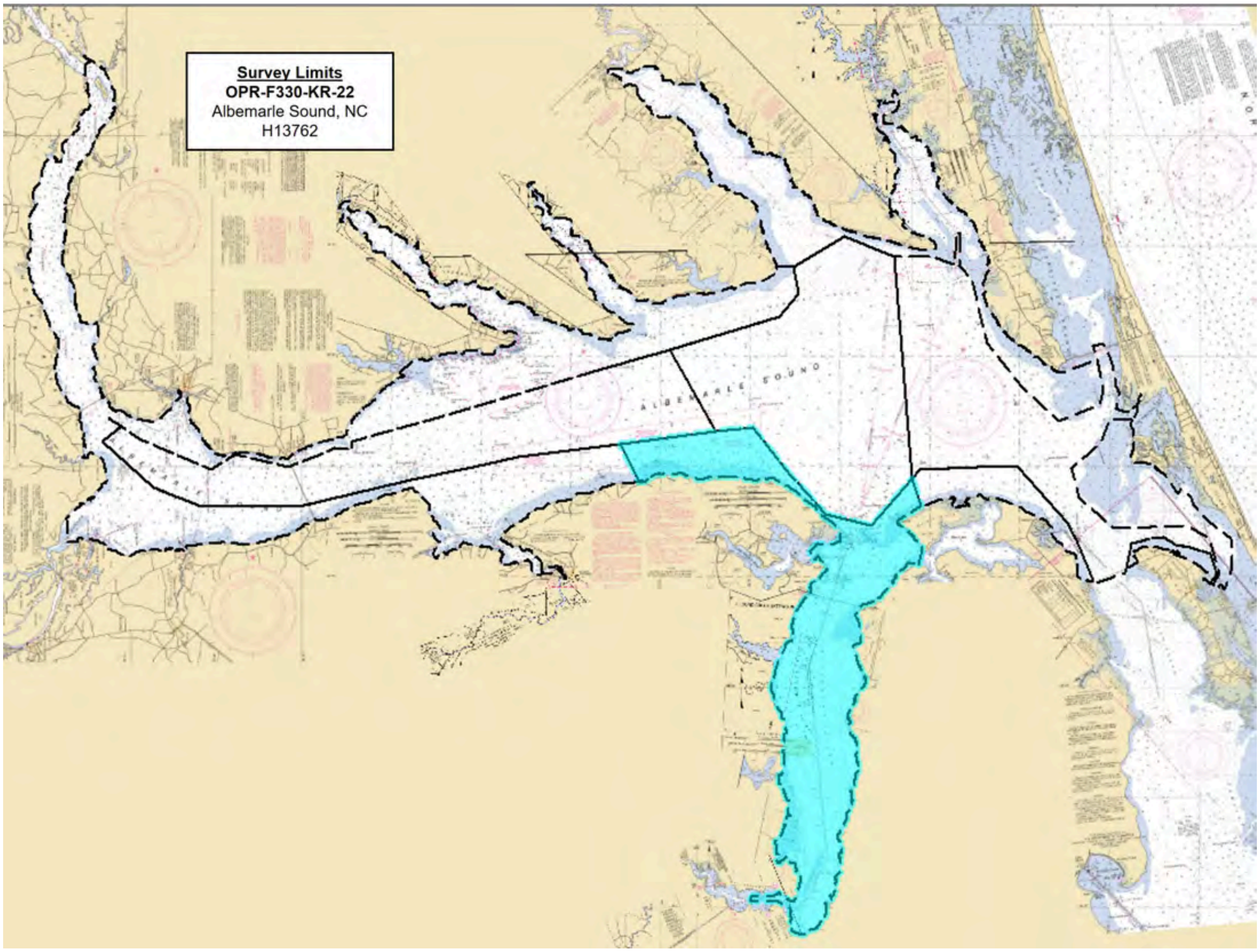


Figure 1: Overview of project survey limits (H13762 shown in blue), overlaid onto Charts 11553, 12205, and 12206

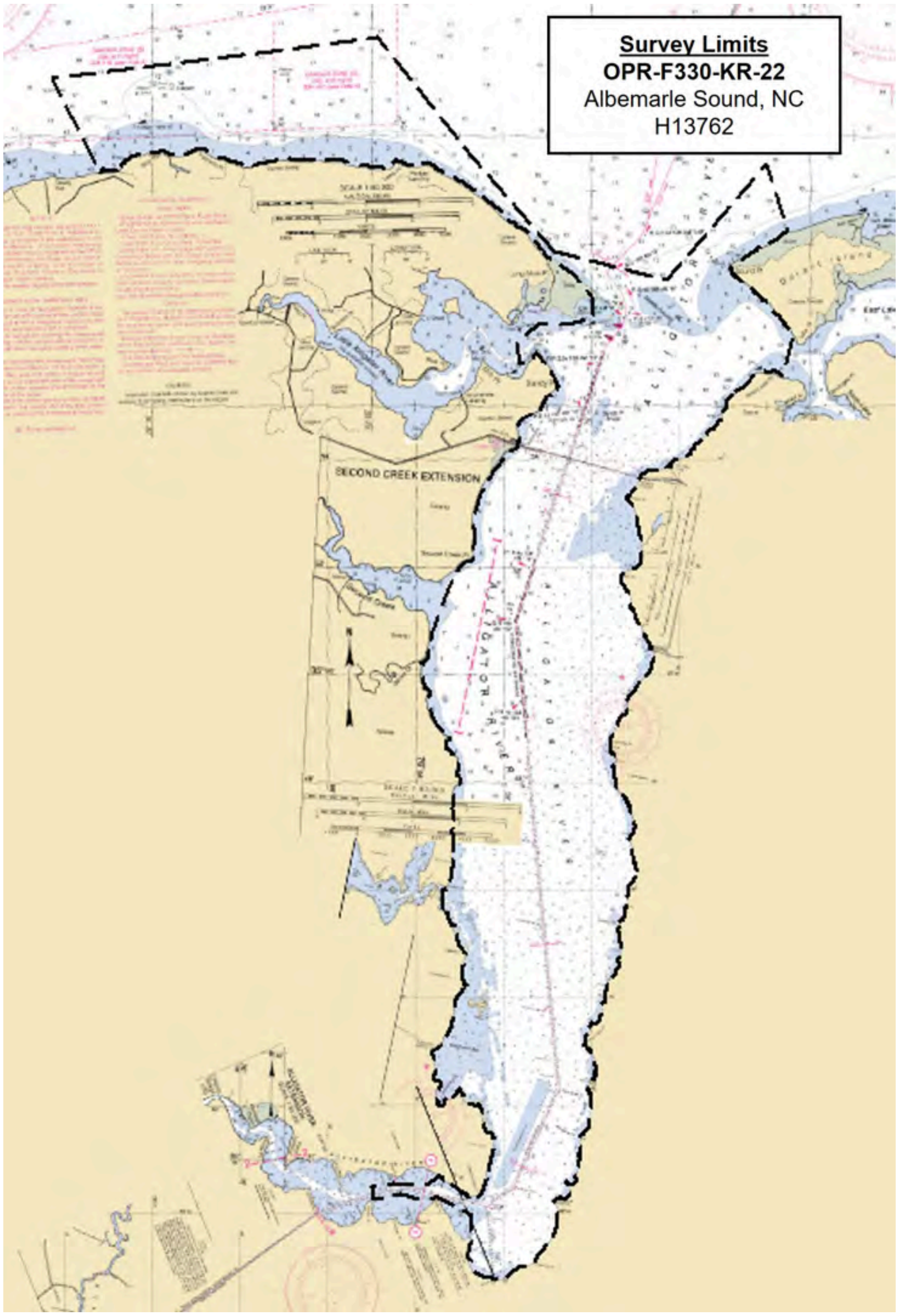


Figure 2: H13762 survey limits overlaid onto Charts 11553 and 12205

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 H13762 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
Inshore limit to 3.5 meters (m)	50 m set line spacing Singlebeam Echosounder (SBES). Refer to HSSD Section 5.2.2.4 Set Line Spacing Option C
3.5 m and greater	Complete Coverage Side Scan Sonar (SSS) with concurrent SBES (Refer to the Special Data Handling Requirements Section of the PI)

Table 2: Survey Coverage

The entirety of H13762 was acquired with complete coverage as described in the Special Data Handling Requirements section of the PI and set line spacing in accordance with section 5.2.2.4 Option C of the HSSD (coverage 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.

Based on field observations, additional guidance from NOAA HSD OPS was given in respect to the SSS coverage requirements that are outlined in the PI. The additional guidance concluded any area deeper than 3.5 m, which is separated from the main central navigation areas by waters shoal of 3.5 m, on the hydrographer's discretion and keeping safety of navigation in mind, may be treated as an area 3.5 m or less, thus not requiring the collection of side scan data. Additionally, to account for the large areas with a flat shallow isobath, it was also agreed upon that in areas with depths that were deeper than 3.5 m but shoaler than 4 m, the collection of side scan data was not required. Maps were provided to NOAA HSD OPS prior to field closure that displayed the side scan coverage obtained in water sheds and tributaries, areas where the developed guidance was most frequently used. The maps were provided to NOAA HSD OPS to assure compliance and welcome feedback to the employed guidance. See DR Appendix II Supplemental Records for related correspondence.

Throughout the survey area NALL was often defined by safety limitations before the prescribed depth limit (2 m) was met, particularly along the shoreline or inhibited due to the presence of recreational fishing gear. Adaptive techniques and tools were used in the field to document areas where the 2 m depth contour was not reached due to safety concerns. More detail on these methods can be found in the DAPR. Figure 4 provides an example of the area defined by the 2 m NALL specification. Occasional deviations from the 50 m set line spacing plan were deemed appropriate for vessel safety as shown in Figure 5. Figures 6-8 provide examples of areas where NALL was defined safety limitations. A large portion of shoreline in H13762 contained dangerous trees and submerged stumps within the survey area. Figures 9 and 10 provide examples of these occurrences.

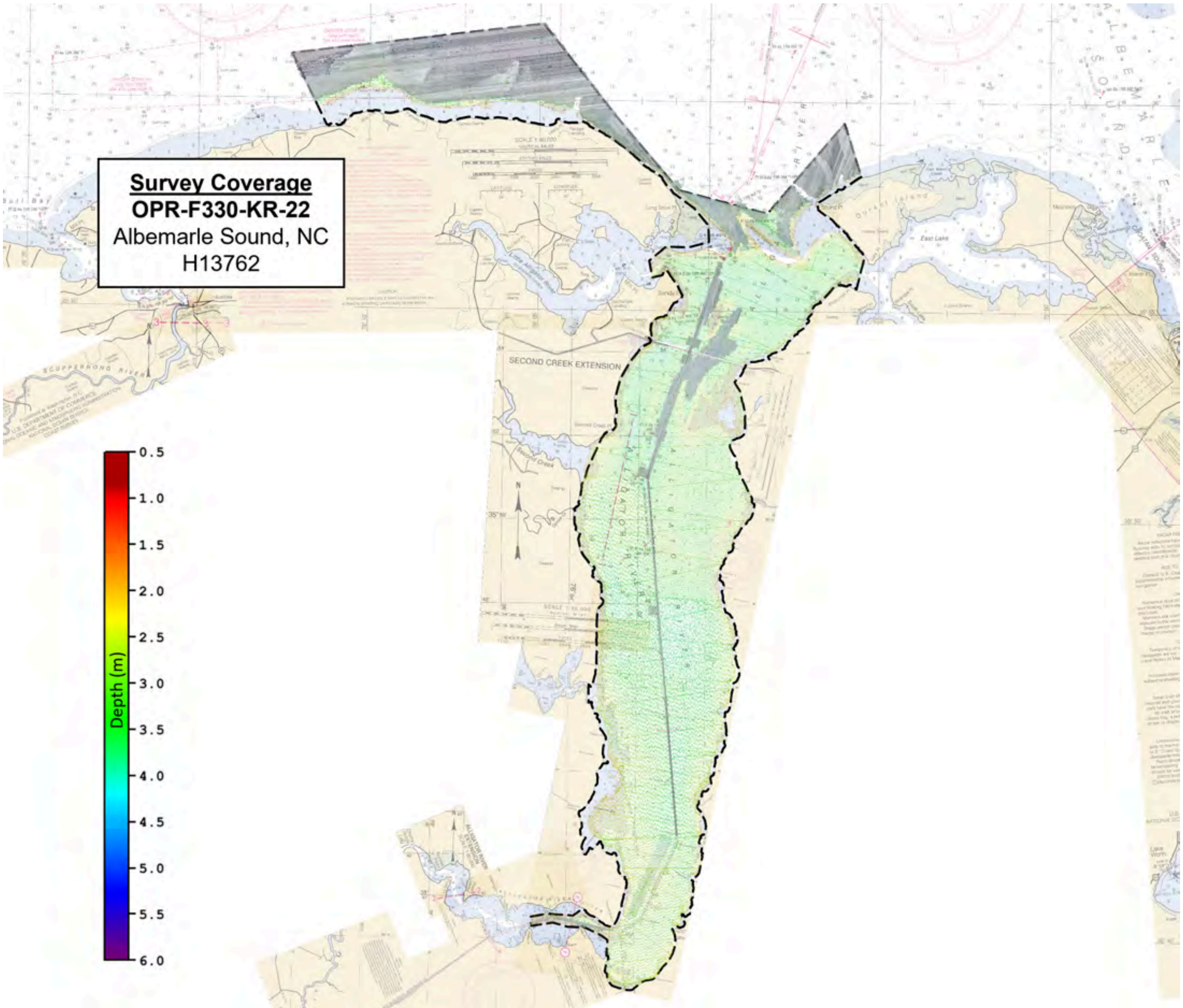


Figure 3: H13762 Complete Coverage SSS (greyscale) with bathymetric coverage and assigned sheet limits in black

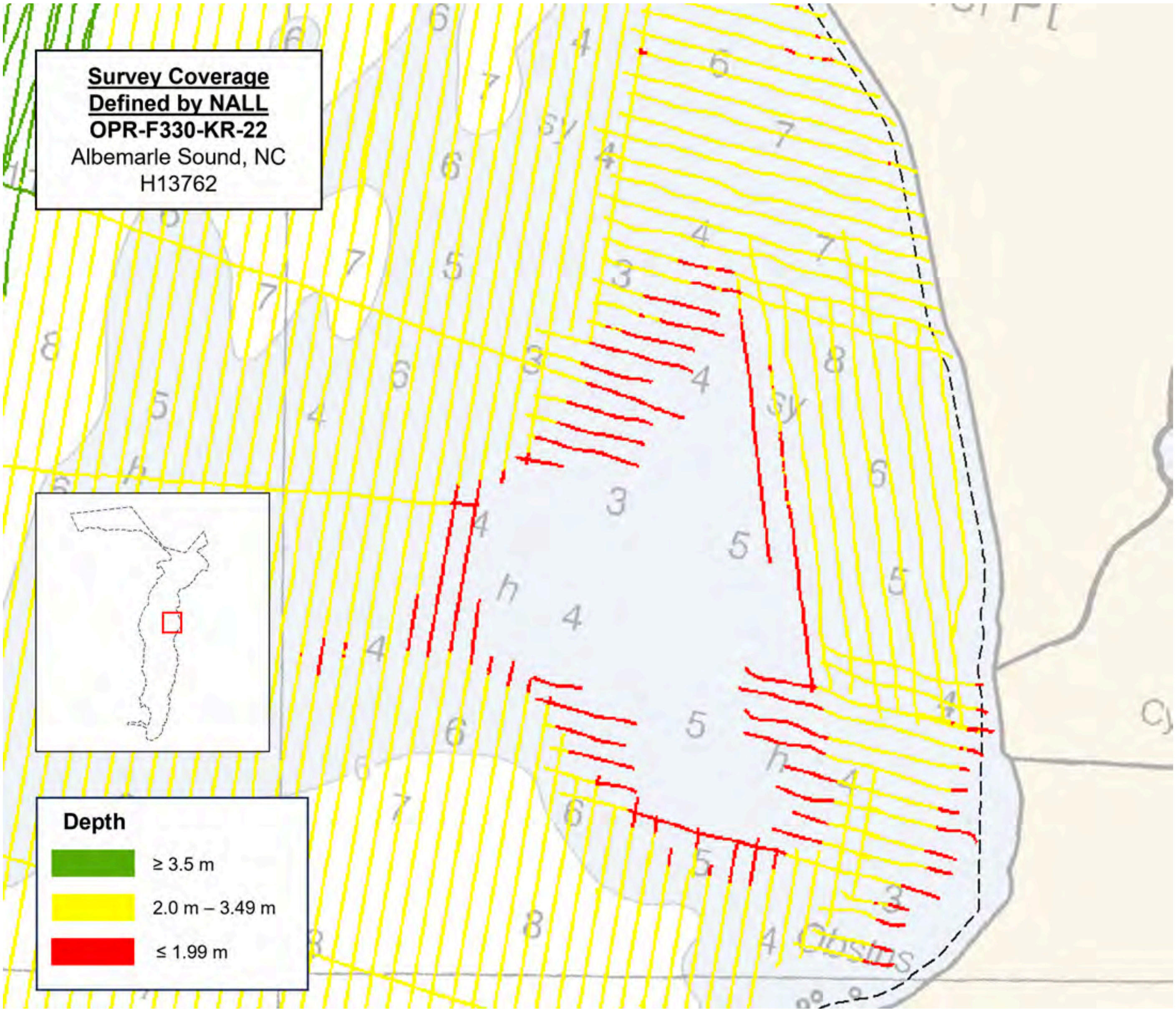


Figure 4: Area in H13762 where NALL is defined by depth (2m)

Figure 5: Several features within SBES set line coverage areas were deemed unsafe to transit directly transit over, and deviations around several charted features were made.

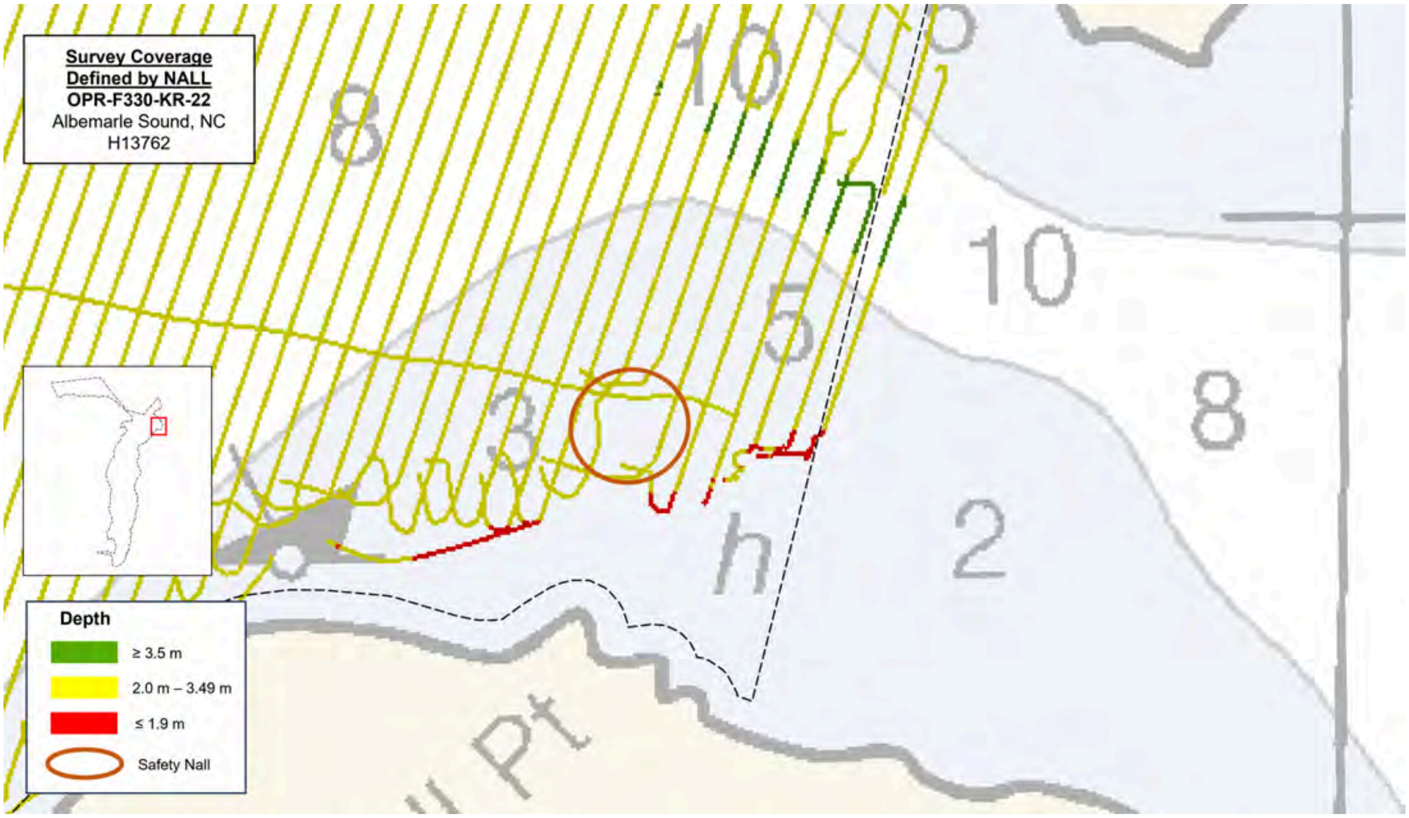


Figure 6: Area in H13762 where safety defined NALL because of fishing gear, resulting in a gap in data

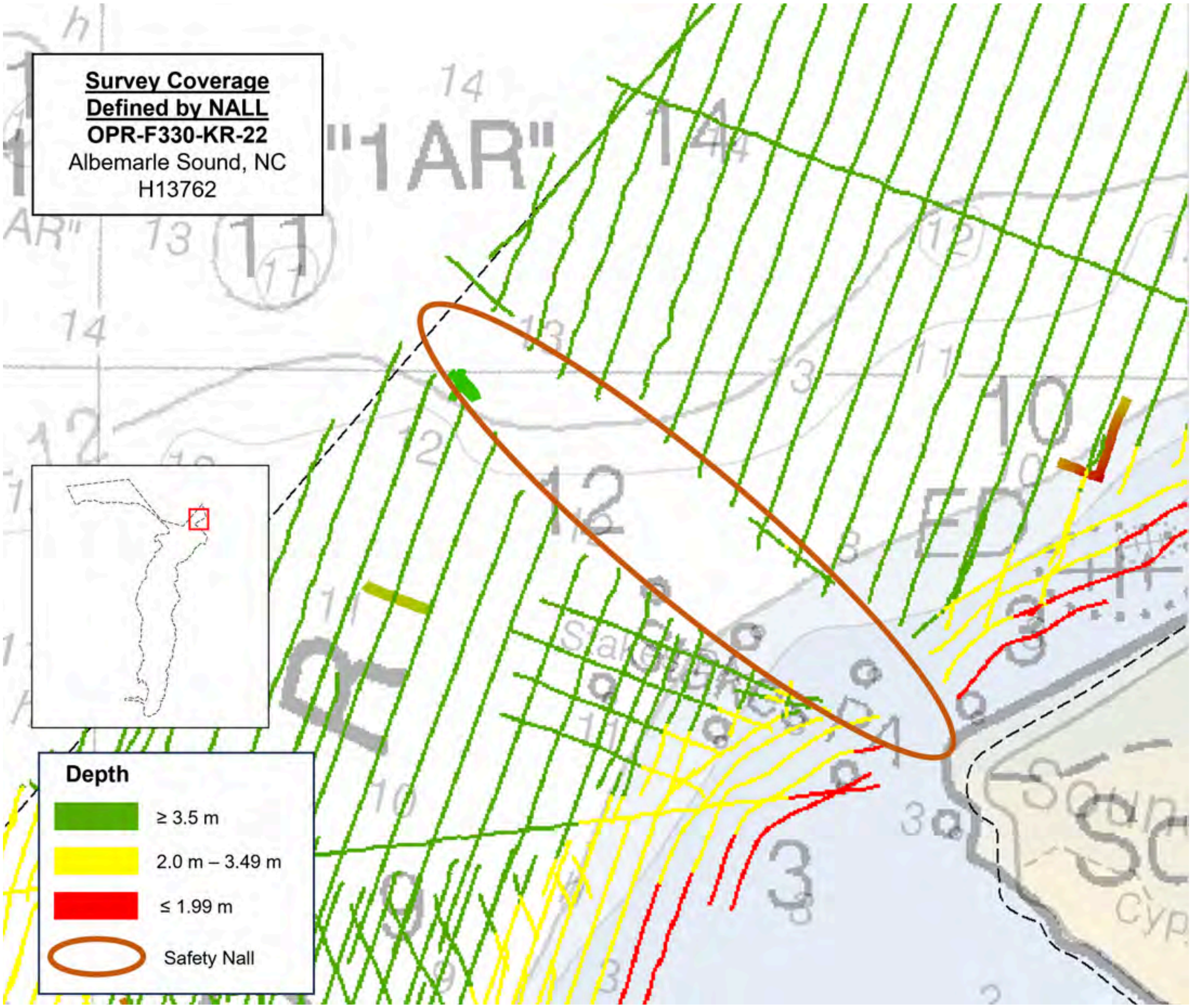


Figure 7: Area in H13762 where safety defined NALL because of fishing gear, area reported as DTON

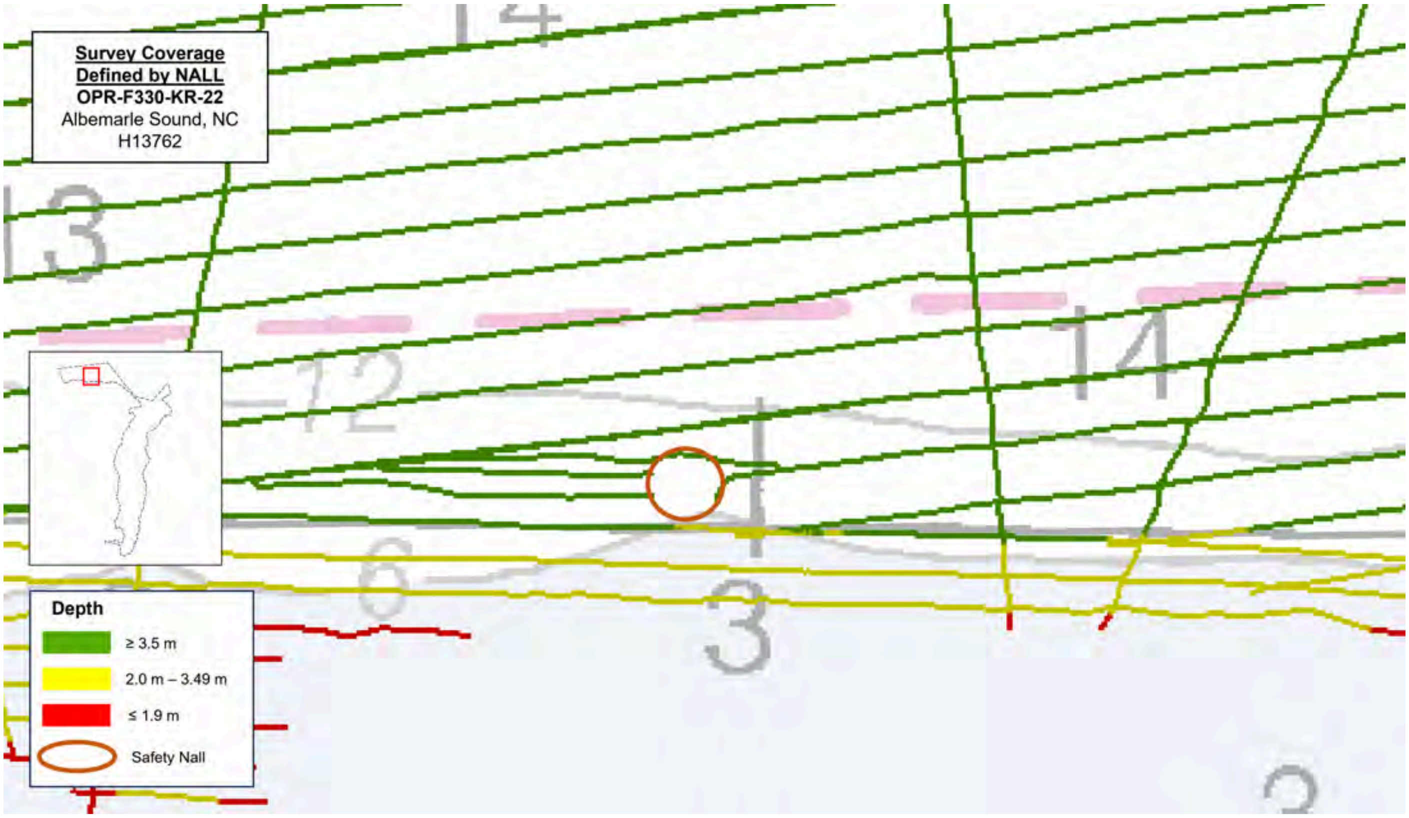


Figure 8: Area in H13762 where safety defined NALL because of fishing gear, resulting in a gap in data

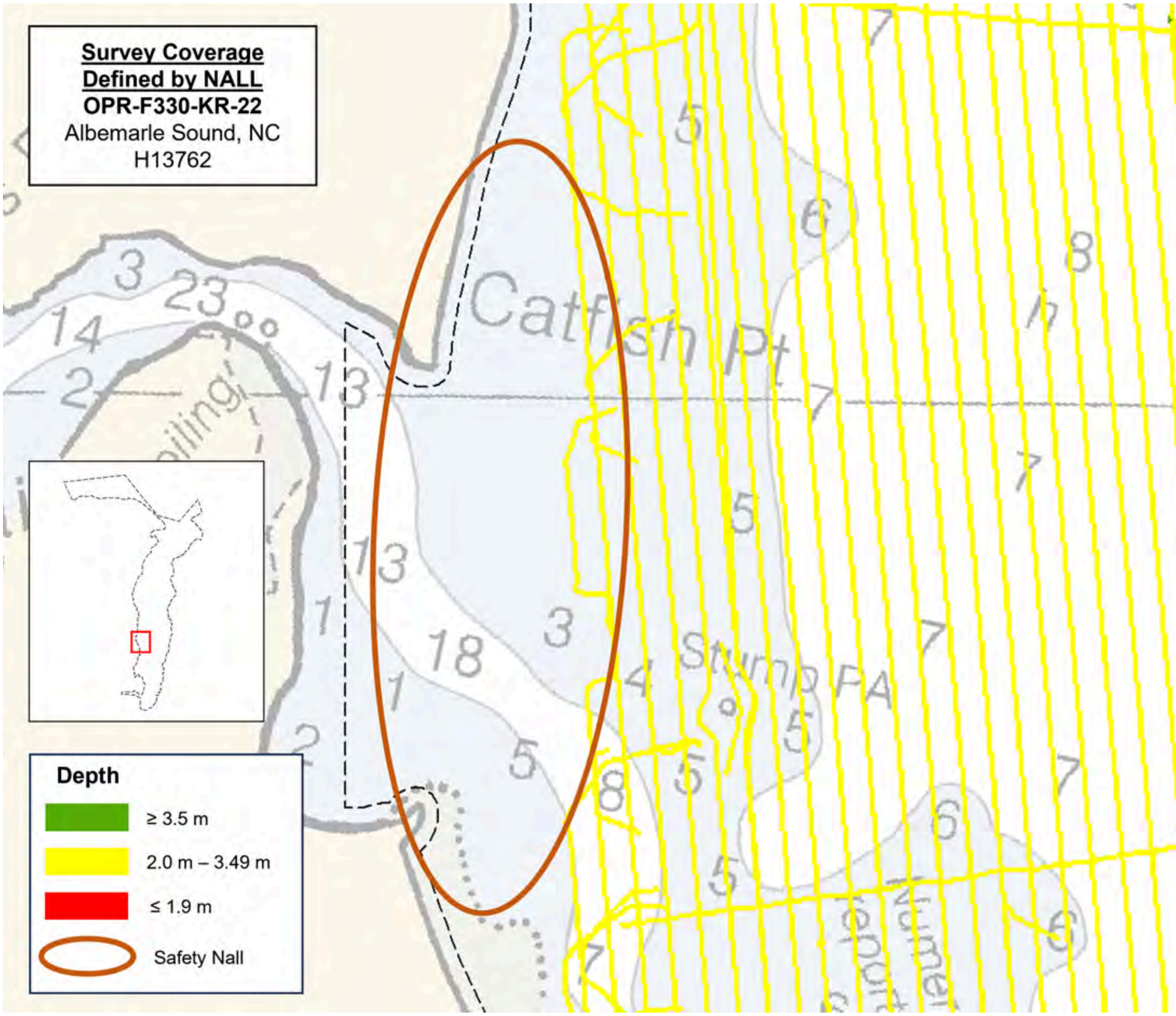


Figure 9: Area in H13762 where safety defined NALL due to proximity to trees on the shoreline

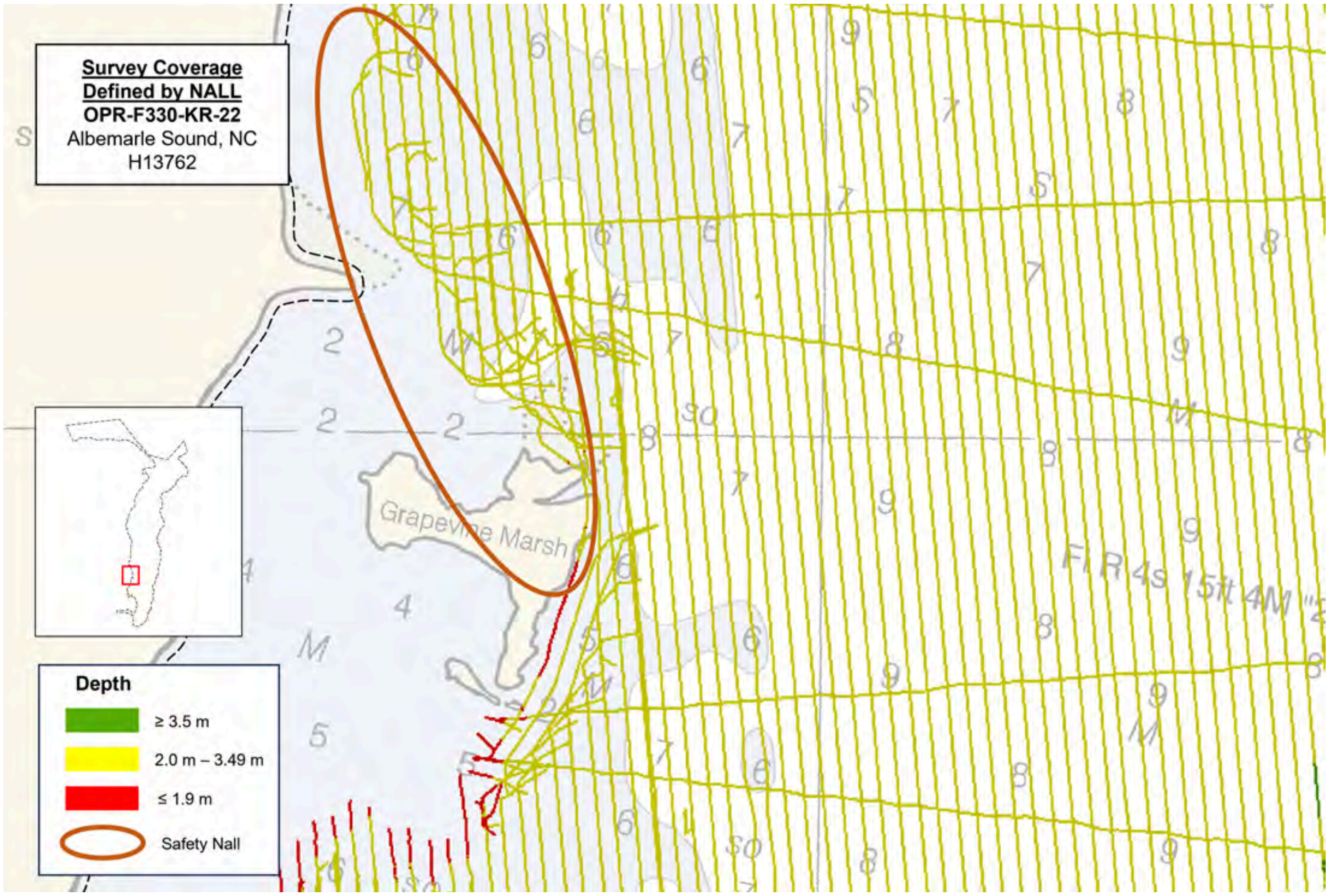


Figure 10: Area in H13762 where safety defined NALL due to dangerous trees and stumps in area

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*	*X-15*	*X-19*	*Total*
LNM	SBES Mainscheme	319.87	27.42	562.5	787.59	992.55	2689.96
	MBES Mainscheme	0.0	10.73	8.1	0.0	0.0	18.84
	Lidar Mainscheme	0.0	0.0	0.0	0.0	0.0	0.0
	SSS Mainscheme	54.42	25.45	401.45	0.0	0.0	481.32
	SBES/SSS Mainscheme	0.0	0.0	0.0	0.0	0.0	0.0
	MBES/SSS Mainscheme	0.0	0.0	0.0	0.0	0.0	0.0
	SBES/MBES Crosslines	140.97	0.0	14.41	0.0	0.0	155.38
	Lidar Crosslines	0.0	0.0	0.0	0.0	0.0	0.0
Number of Bottom Samples							2
Number Maritime Boundary Points Investigated							0
Number of DPs							0
Number of Items Investigated by Dive Ops							0
Total SNM							66.2

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
02/24/2023	55

Survey Dates	Day of the Year
02/25/2023	56
02/26/2023	57
03/01/2023	60
03/06/2023	65
03/11/2023	70
03/12/2023	71
03/13/2023	72
03/14/2023	73
03/15/2023	74
03/16/2023	75
03/17/2023	76
03/18/2023	77
03/19/2023	78
03/20/2023	79
03/21/2023	80
03/22/2023	81
03/23/2023	82
03/24/2023	83
03/25/2023	84
03/26/2023	85
03/27/2023	86
03/28/2023	87
03/29/2023	88
03/30/2023	89
03/31/2023	90
04/02/2023	92
04/03/2023	93
04/04/2023	94
04/05/2023	95
04/06/2023	96
04/07/2023	97
04/08/2023	98

Survey Dates	Day of the Year
04/09/2023	99
04/10/2023	100
04/11/2023	101
04/12/2023	102
04/13/2023	103
04/14/2023	104
04/15/2023	105
04/22/2023	112
04/23/2023	113
04/25/2023	115
04/26/2023	116
05/02/2023	122
05/03/2023	123
05/04/2023	124
06/09/2023	160
06/10/2023	161
06/11/2023	162
06/12/2023	163
06/13/2023	164
06/20/2023	171
06/21/2023	172
06/22/2023	173
06/24/2023	175
06/25/2023	176
06/26/2023	177
07/06/2023	187
07/07/2023	188
07/08/2023	189
07/09/2023	190
07/10/2023	191
07/11/2023	192
07/12/2023	193

Survey Dates	Day of the Year
10/07/2023	280
10/08/2023	281
10/09/2023	282
10/10/2023	283
10/13/2023	286
10/24/2023	297

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***	***X-15***	***X-19***
LOA	7.62 meters	9.14 meters	9.44 meters	4.5 meters	4.5 meters
Draft	0.91 meters	0.61 meters	0.61 meters	0.65 meters	0.65 meters

Table 5: Vessels Used

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

B.1.2 Equipment

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

Manufacturer	Model	Type
Kongsberg Maritime	EM 2040C	MBES
Teledyne Odom Hydrographic	Echotrac E20	SBES
Teledyne Odom Hydrographic	Echotrac CV100	SBES
EdgeTech	4205	SSS
Applanix	POS MV OceanMaster	Positioning and Attitude System
Applanix	POS MV WaveMaster	Positioning and Attitude System
AML Oceanographic	BaseX2	Sound Speed System
AML Oceanographic	AML-3 LGR	Sound Speed System
AML Oceanographic	MicroX SV	Sound Speed System
Valeport	SWiFT SVP	Sound Speed System

Table 6: Major Systems Used

The R/V Benthos and R/V 4-Points were installed with a Teledyne Echotrac E20 while the R/V Chinook was installed with a Teledyne Echotrac CV100. All Geodynamics owned vessels utilized a dual-head Kongsberg EM 2040C multibeam system, a POS M/V OceanMaster positioning and attitude system, an EdgeTech 4205 side scan towfish for side scan operations, and AML Oceanographic surface sound speed units. The X-15 and X-19 utilized a POS M/V WaveMaster for positioning and attitude as well as an Echotrac E20 singlebeam system. For sound speed profiles, the R/V Benthos and R/V Chinook utilized an AML BaseX2 system, the R/V 4-Points utilized an AML-3 LGR, while both X-15 and X-19 utilized a Valport SWiFT SVP. Further details on equipment and software used can be found in the DAPR.

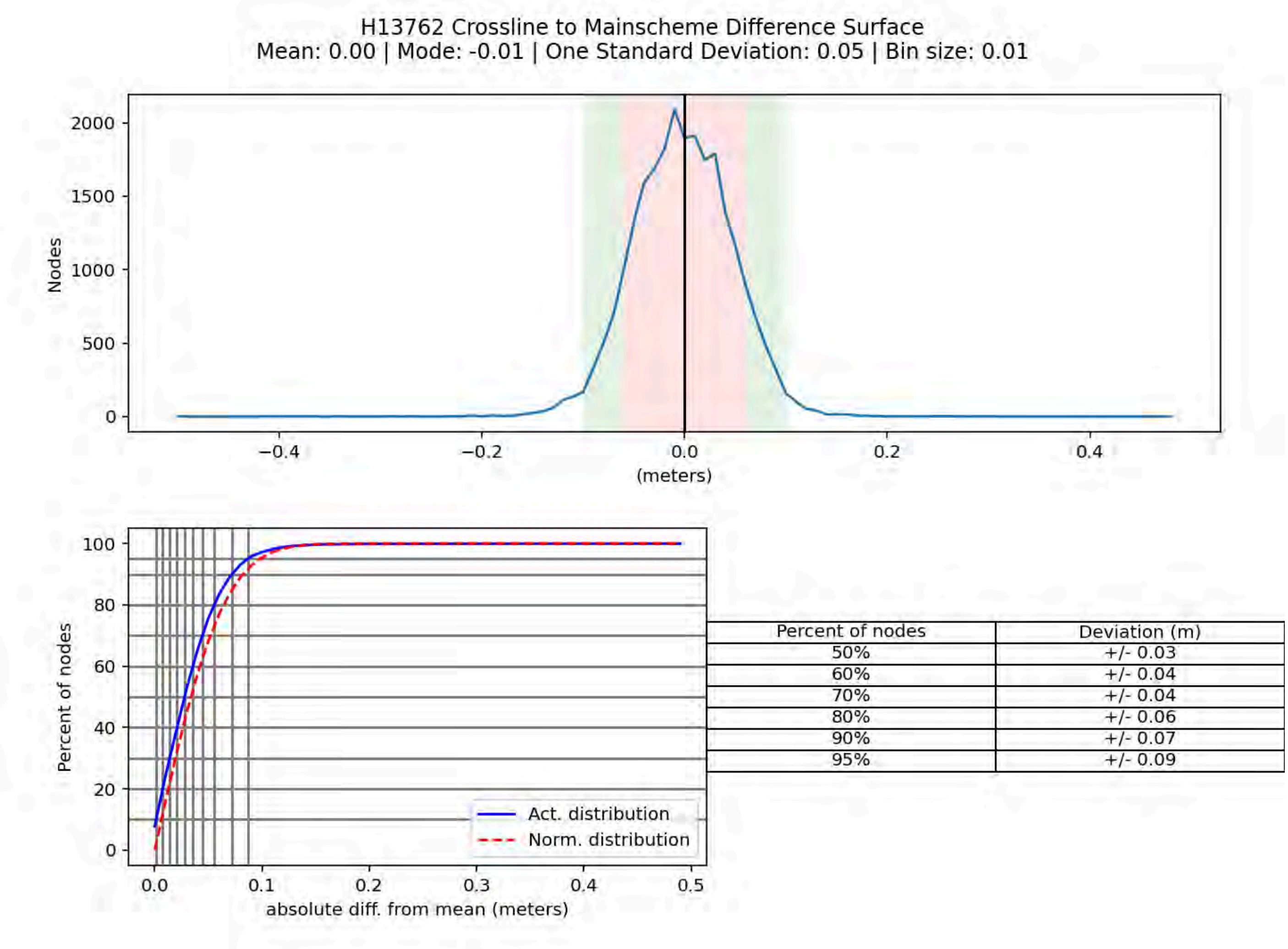
B.2 Quality Control

B.2.1 Crosslines

Singlebeam crosslines acquired for H13762 totaled 5.74% of mainscheme acquisition. In conjunction with the NOAA HSD PM/COR, it was agreed upon that a crossline percentage of approximately 5% of the mainscheme linear nautical miles was acceptable for mixed coverage sheets. Please see DR Appendix II Supplemental Records for the related correspondence.

H13762 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 4 m surface was generated with strictly mainscheme data and another, separate 4 m surface was generated with only crossline data. The mainscheme surface was created by mosaicking the mainscheme 4 m SBES CARIS Uncertainty surface (using the shoal layer) with the 1 m MBES CUBE surface (depth layer). A separate 4 m SBES Uncertainty surface containing only crosslines was created and the shoal layer from that surface was used for analysis. It should be noted in mixed coverage sheets crosslines were SBES only. The mainscheme and crossline files 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 +/- 0.09 m, with a mean difference of 0.00 m (Figure 11). 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%	+/- 0.03
60%	+/- 0.04
70%	+/- 0.04
80%	+/- 0.06
90%	+/- 0.07
95%	+/- 0.09

Figure 11: H13762 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
X-15	2.00 meters/second	N/A meters/second	N/A meters/second	0.05 meters/second
X-19	2.00 meters/second	N/A meters/second	N/A meters/second	0.05 meters/second

Table 8: Survey Specific Sound Speed TPU Values.

The finalized CUBE and Uncertainty surfaces were 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 and Uncertainty surfaces met or exceeded the TVU specifications, as shown in Figures 12-13.

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. The singlebeam surface was finalized with the standard deviation of soundings at 95% confidence interval assigned as the uncertainty value.

It should be noted that the uncertainty associated with the SEP model is applied in CARIS as the GPS sounding datum for multibeam data and applied as Tide Zoning for singlebeam data.

Additional details related to uncertainty methods may be found in the DAPR.

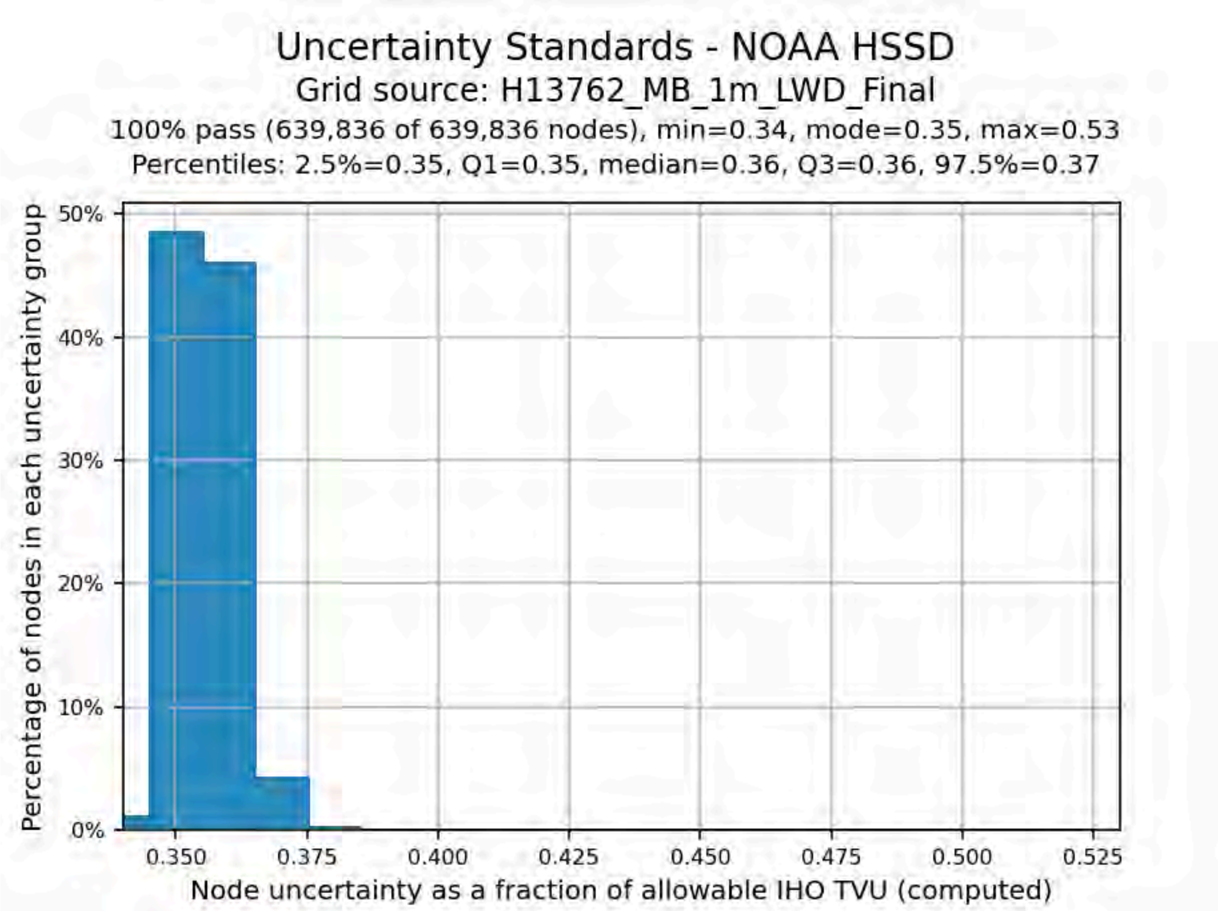


Figure 12: Finalized MBES 1m CUBE surface TVU statistics for H13762

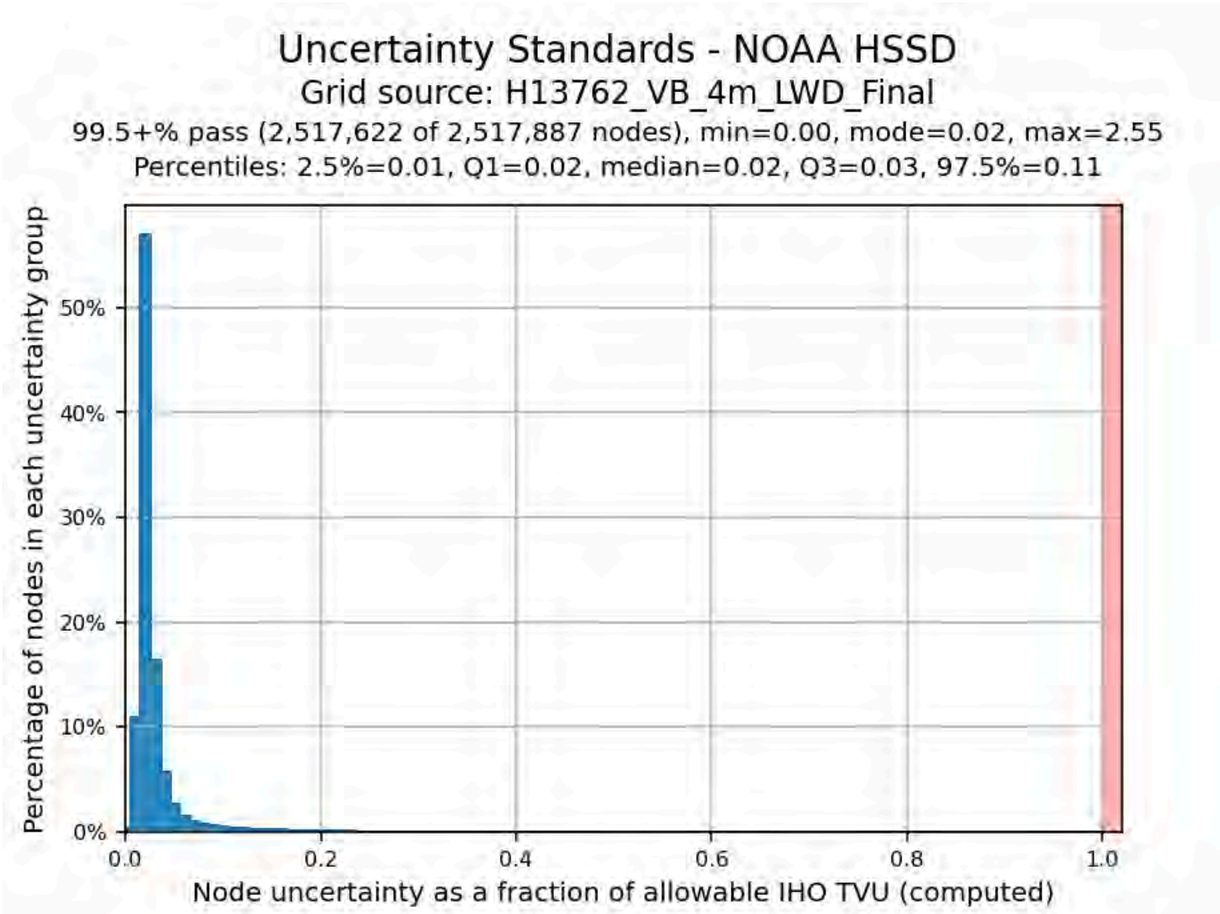


Figure 13: Finalized SBES 4m Uncertainty surface TVU statistics for H13762

B.2.3 Junctions

No junctioning surveys were provided for this project (see PI). However, H13762 junctions with H13755, H13758, H13760, H13761, and H13764 (Figure 14). Data overlap between H13762 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. Please reference the Descriptive Reports for H13755, H13758, H13760, and H13761 for junction analyses results to H13762. 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.

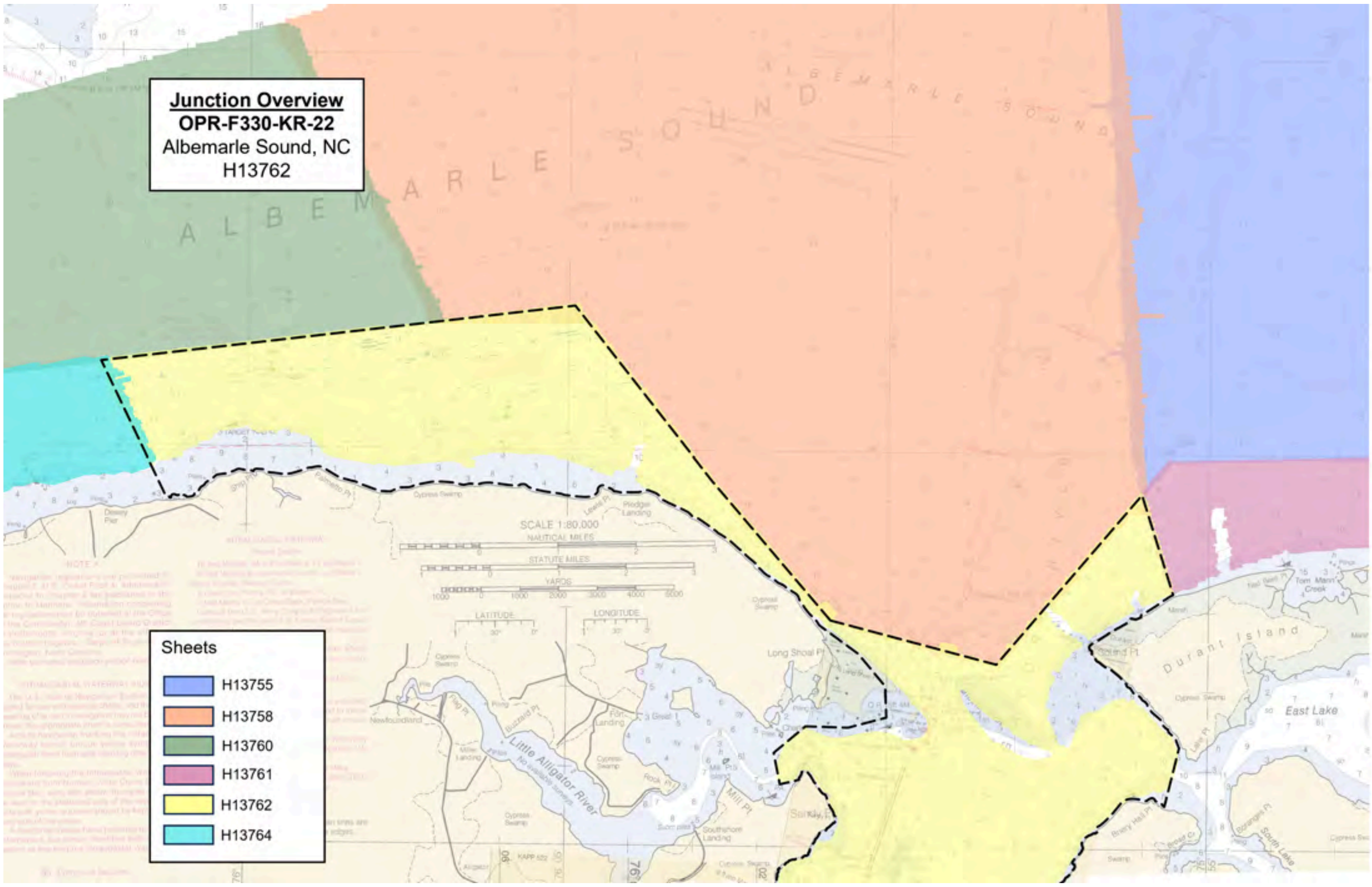


Figure 14: Overview of H13762 junction surveys

The following junctions were made with this survey:

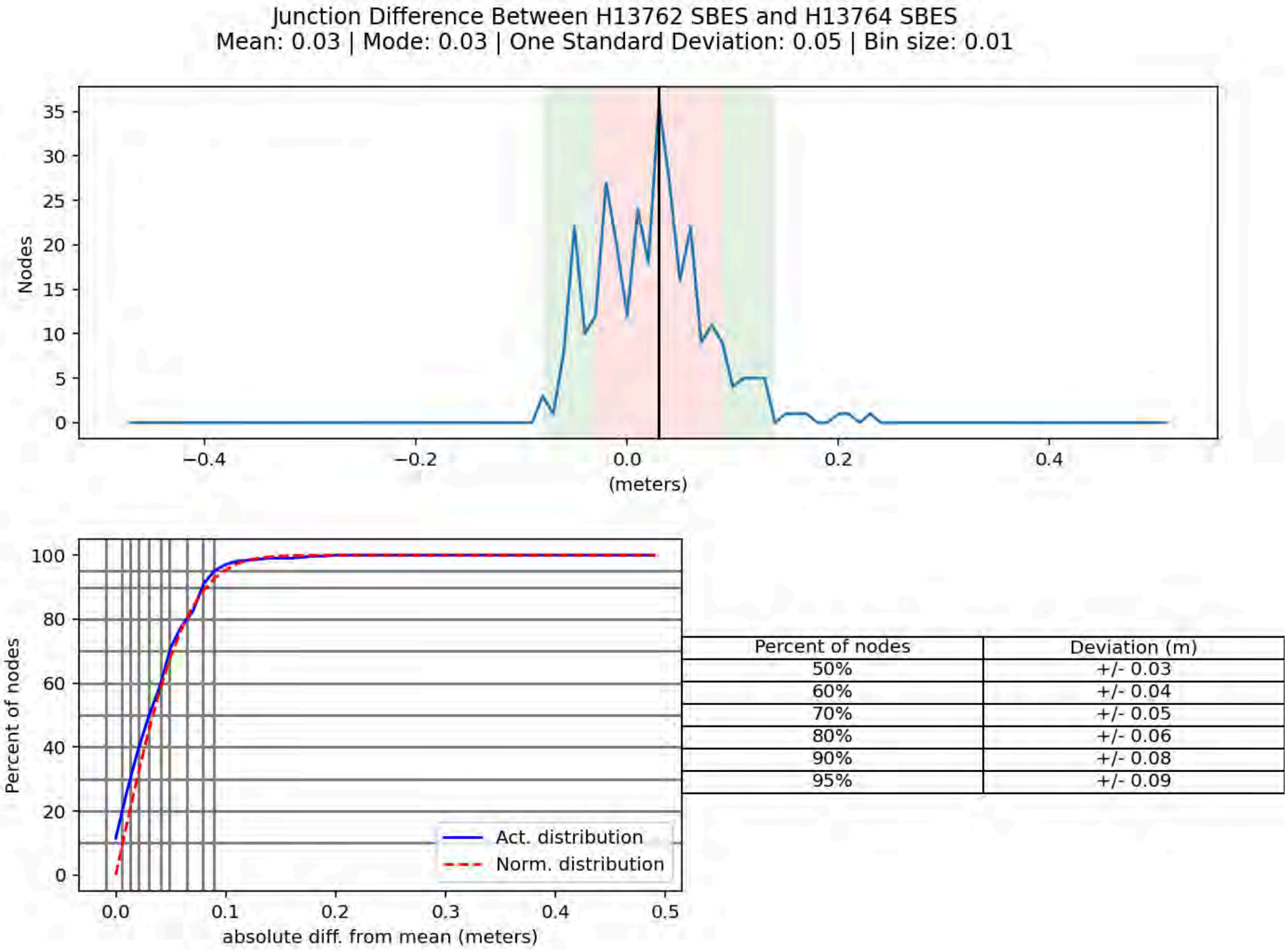
Registry Number	Scale	Year	Field Unit	Relative Location
H13764	1:5000	2023	Geodynamics	W

Table 9: Junctioning Surveys

<u>H13764</u>

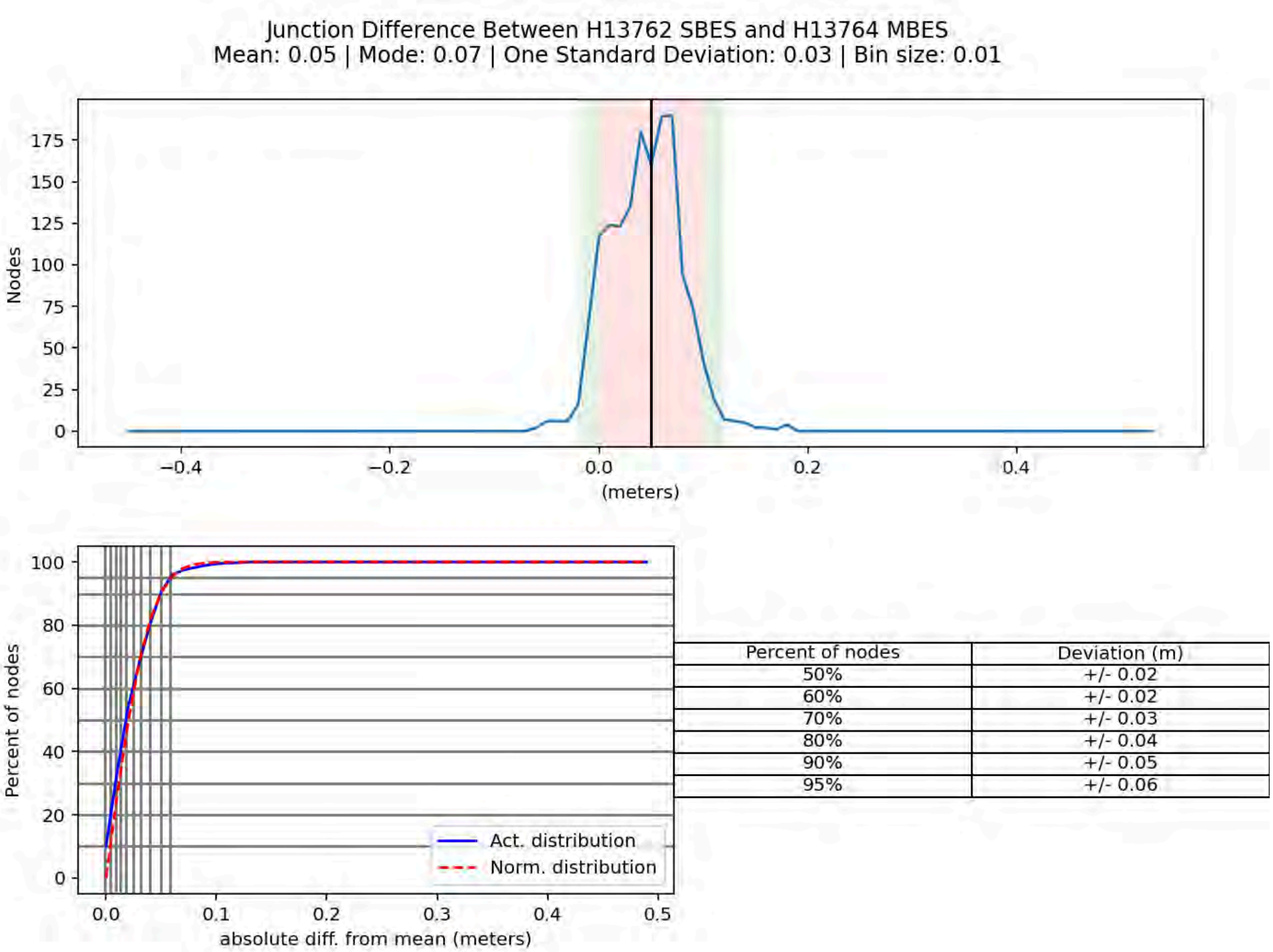
For H13762 SBES to H13764 SBES, the statistical results of the difference comparison shows 95% of nodes falling within +/- 0.09 m, with a mean difference of 0.03 m (Figure 15). Additionally, at least 95% of surface nodes met or exceed TVU specifications, as described in section 5.1.3 of the HSSD.

For H13762 SBES to H13764 MBES, the statistical results of the difference comparison shows 95% of nodes falling within +/- 0.06 m, with a mean difference of 0.05 m (Figure 16). Additionally, at least 95% of 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%	+/- 0.04
70%	+/- 0.05
80%	+/- 0.06
90%	+/- 0.08
95%	+/- 0.09

Figure 15: Junction analysis between H13762 SBES and H13764 SBES



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

Figure 16: Junction analysis between H13762 SBES and H13764 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 Side Scan 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).

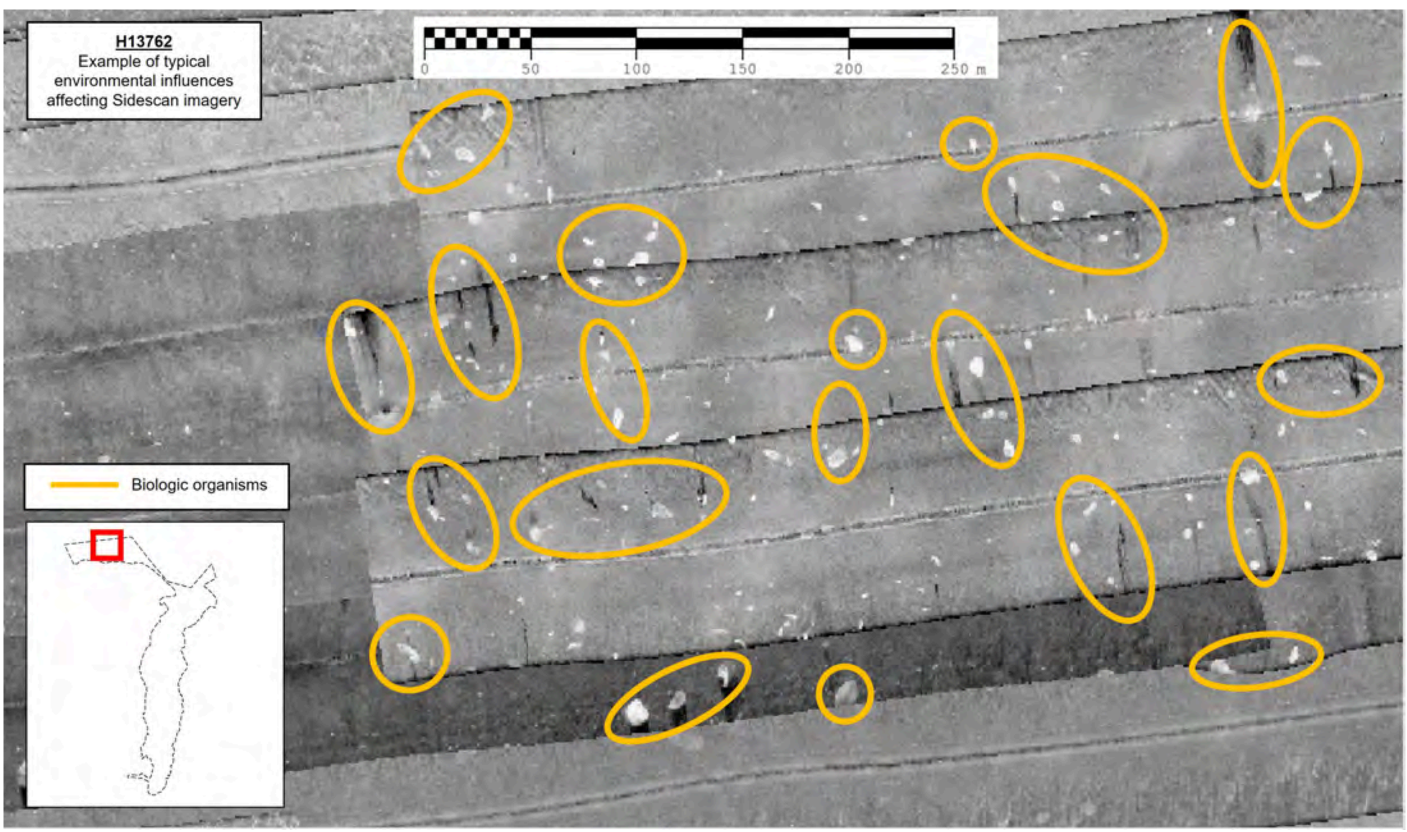


Figure 17: Example of environmental influences affecting SSS imagery which were persistent throughout the survey area, present within the final delivered mosaic.

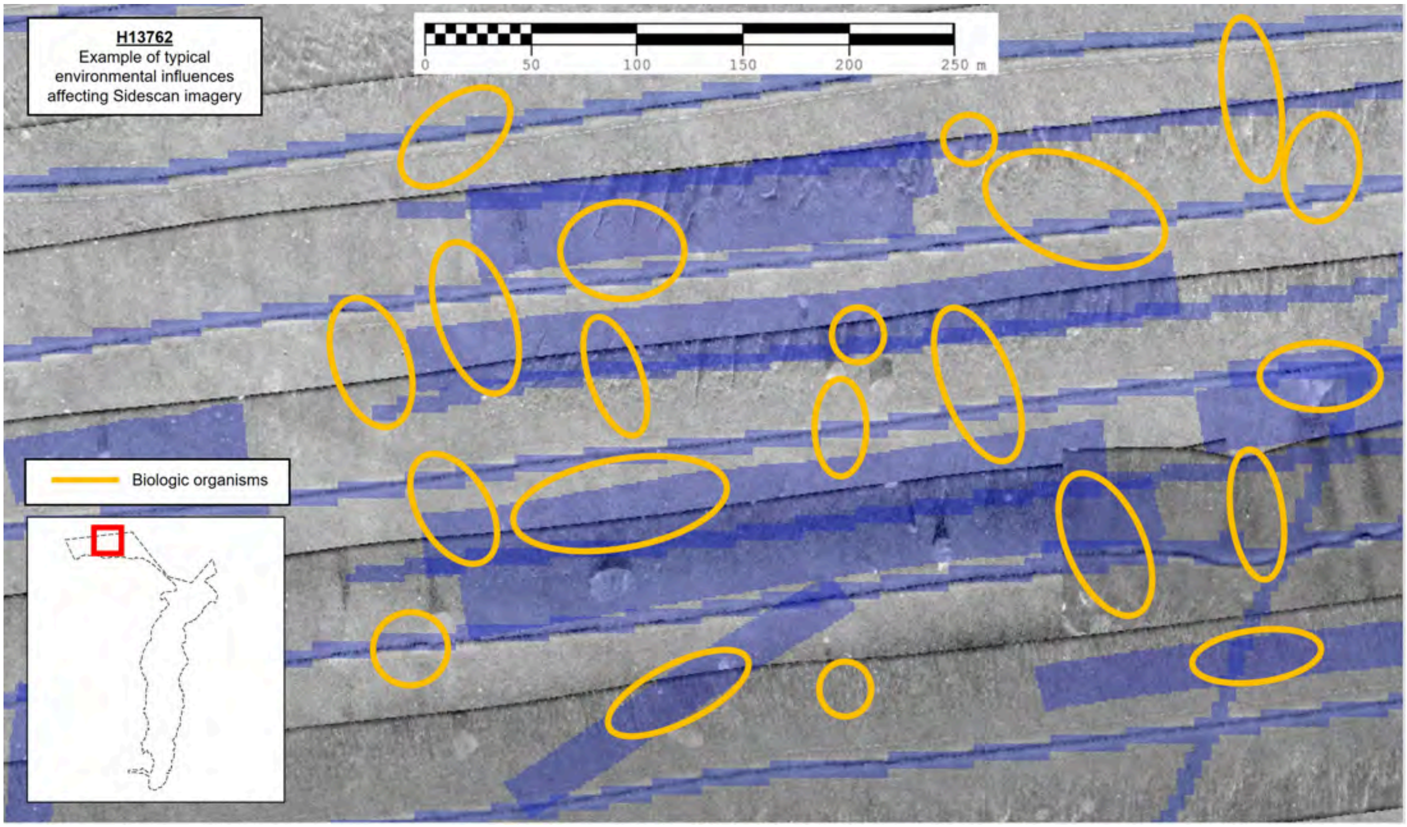


Figure 18: Example of the use of MBES recoveries, SBES nadir coverage, and additional overlapping SSS imagery to confirm adequate coverage and identification of any potential seafloor features.

Side Scan Towfish Altitude and Coverage 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. Adjusted altitude requirements as well as the approval of the .tif trimming method of addressing deviations from the towfish altitude requirements (as outlined in the PI) can be found in the project correspondence as well as detailed in the DAPR.

Hydrographer discretion and best practices were utilized where the depth contour or the NALL defined by safety limitations determined the change in coverage type. Artifacts on the edges of SSS imagery where the coverage type changed were reviewed in detail and reacquired with additional side scan sonar or multibeam bathymetry when safe and practicable.

Multibeam Echosounder Ping Drops

On very rare occasion, it was observed that the multibeam echosounder would experience a "ping drop" issue that resulted in unexpected missing ping records, which were not observed by the survey vessel at the time of acquisition. An example of this ping drop can be seen in Figure 19. 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.

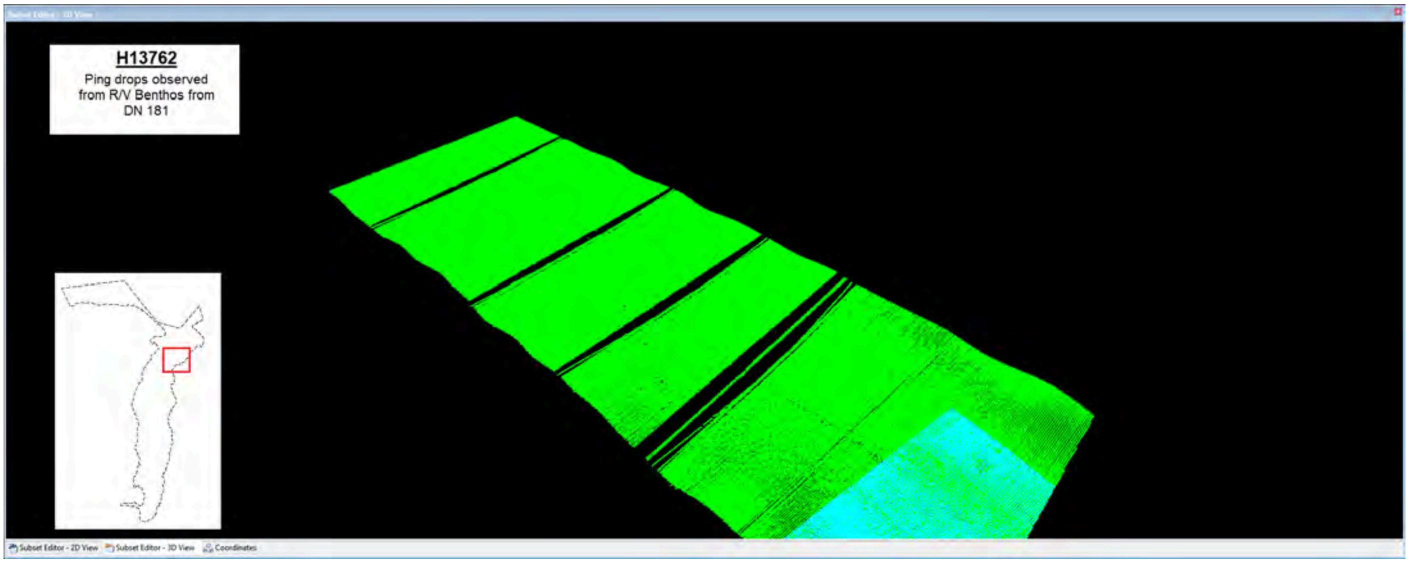


Figure 19: Example of MBES ping drop observed from R/V Benthos on DN 181

Recreational Fishing Gear

Throughout the survey area, crab pots and other types of recreational fishing gear were observed or identified within the data. Particular attention was taken to avoid gear interactions and promote the safety of vessels and equipment, and at times defined the survey limits, as described in section A.4. Crab pots were often identified within the side scan sonar imagery or multibeam data and found to be of dimensions that did not warrant investigation. These objects were rejected from the MBES 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.

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: When collecting multibeam data, casts were often taken every two hours, never exceeding the four hour limit, and immediately following transit to a new location. When collecting SBES data, generally two casts per day were conducted.

During MBES data collection, 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 and Uncertainty surfaces were analyzed using HydrOffice QC Tools Grid QA tool to assure data met the required density specifications. Density requirements were achieved for the finalized surfaces in H13762 with at least 95% of the MBES CUBE surface nodes (Figure 20) and at least 95% of the SBES Uncertainty surface nodes (Figure 21) containing at least five or more soundings, exceeding the specifications required by section 5.2.2.3 of the HSSD.

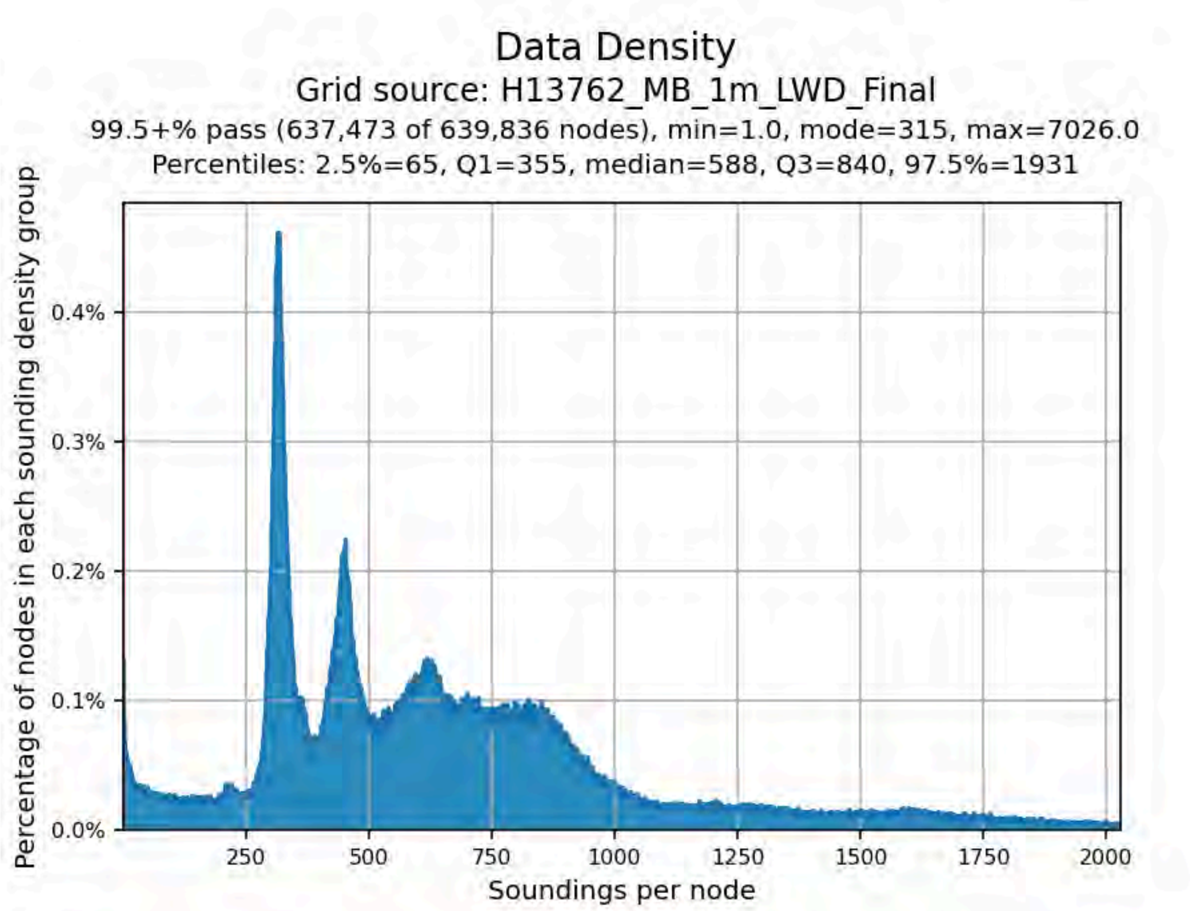


Figure 20: Finalized MBES 1 m CUBE surface density statistics for H13762

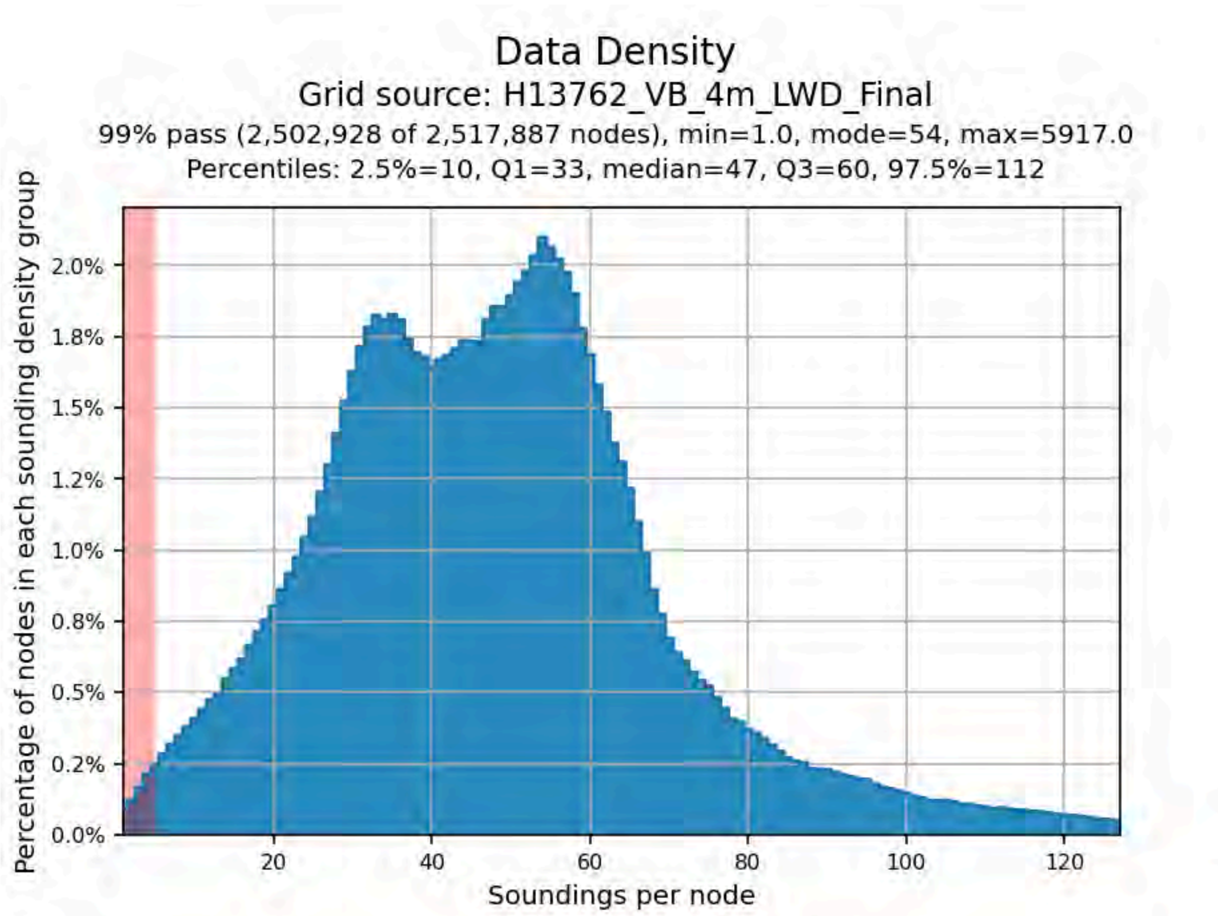


Figure 21: Finalized SBES 4 m Uncertainty surface density statistics for H13762

B.2.10 Flier Finder

In addition to a visual inspection, the multibeam 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.

For SBES flier identification, the Uncertainty surface shoal layer was reviewed manually in CARIS. In addition to a thorough visual inspection of the surface, the review involved applying display filters to the surface that flagged potential fliers and helped the hydrographer spot any anomalies. An emphasis was put on manual inspection because the Flier Finder tool in Pydro was found to be unreliable when searching for fliers in the SBES surfaces. See DAPR for more information on SBES quality control measures.

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 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. These manual evaluation methods were also employed to assess SBES.

The main source of data gaps in the MBES 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 MBES data, and are not reflected in the final surface.

The side scan mosaic was extensively reviewed for environmental influences which would prevent the detection of a 1m x 1m x 1m object, and where those were identified, additional SSS or MBES data was 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
Xylem	Hypack	2022.Q3

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
Chesapeake 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 values for singlebeam surfaces are representative of the shoal layer. The singlebeam grid contains bathymetry data for both set line spacing and for filling the SSS nadir gap in full coverage areas. The multibeam CUBE surface is for fill and investigations. See DAPR for more details on the utilization of each sensor.

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
H13762_MB_1m_LWD_Final	CARIS Raster Surface (CUBE)	1 meters	1.11 meters - 6.08 meters	NOAA_1m	Complete MBES
H13762_MB_1m_LWD	CARIS Raster Surface (CUBE)	1 meters	2.88 meters - 6.08 meters	NOAA_1m	Complete MBES
H13762_VB_4m_LWD_Final	CARIS Raster Surface (Uncertainty)	4 meters	0.38 meters - 6.14 meters	NOAA_4m	SBES Set Line Spacing
H13762_VB_4m_LWD	CARIS Raster Surface (Uncertainty)	4 meters	0.38 meters - 6.14 meters	NOAA_4m	SBES Set Line Spacing
H13762_SSSAB_1m_540kHz_1of2	SSS Mosaic	1 meters	-	NOAA_1m	100% SSS
H13762_SSSAB_1m_540kHz_2of2	SSS Mosaic	1 meters	-	NOAA_1m	200% SSS
H13762_MBAB_2m_Benthos_300kHz_1of1	MB Backscatter Mosaic	2 meters	-	NOAA_2m	Complete MBES
H13762_MBAB_2m_Chinook_300kHz_1of1	MB Backscatter Mosaic	2 meters	-	NOAA_2m	Complete MBES

Table 12: Submitted Surfaces

"H13762_SSSAB_1m_540kHz_1of2" represents the 100% complete coverage of the mainscheme acquisition sheetwide, while "H13762_SSSAB_1m_540kHz_2of2" is the 200% coverage required for feature disproval.

It should be noted that SBES data were cleaned with an emphasis to best represent objects extending from the seafloor. The shoal layer within the Uncertainty surface best represents these objects in the grid. These objects were not investigated further because of safety limitations. See Figure 22 for an example of bottom objects within the 4 m Uncertainty surface shoal layer.

All surfaces submitted are in compliance with the set line spacing requirement per section 5.2.2.4 Option C of the HSSD and the Complete Coverage SSS with Concurrent SBES Requirements outlined in 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.

Figure 22: Image with significant bottom objects in SBES surface seen in shoal layer

B.5.3 Designated Soundings

H13762 contains 34 designated soundings in accordance with sections 5.2.1.2.3 and 7.4 of the HSSD. 33 of these designated soundings were created to facilitate feature management and best represent the least depths of features in the Final Feature File (FFF). One designated soundings was utilized for overriding the gridded surface as per HSSD specification 5.2.1.2.3 and is within the boundary of a foul area with the Unique ID of H13762_DTON_08. This feature was investigated before the foul area was fully digitized. Since this designated sounding is within the foul area boundary, the designated sounding is not used as the VALSOU for feature with Unique ID of H13762_DTON_08, as the foul area was not fully ensonified and portions were above water. 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.

<u>ERS Datum Transformation</u>

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 Albemarle_Sound_ITRF-LWD(LMSLxGeoid20B-0.5ft)_m.csar

Table 13: ERS method and SEP file

Real-time positional data were corrected with G2+ and G4+ 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 all multibeam data and in Hypack for all singlebeam data. 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+ and G4+ 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 H13762 and the ENCs listed in Table 14 of section D.1.1. Sounding layers were generated from the CUBE and Uncertainty surfaces and overlaid onto the ENCs to visually assess differences between the surveyed and charted depths.

In addition to a detailed visual inspection in CARIS HIPS, all soundings from the chart were downloaded as a shapefile from NOAA's ENC Direct to GIS application and differenced with the surveyed depths from the 4 m surface in ESRI ArcPro. A statistical analysis of the difference comparison is shown in Figure 23. The surveyed depths from H13762 generally agree with the charted soundings from the largest scale ENCs within the survey area, with a mean difference of -0.60 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.

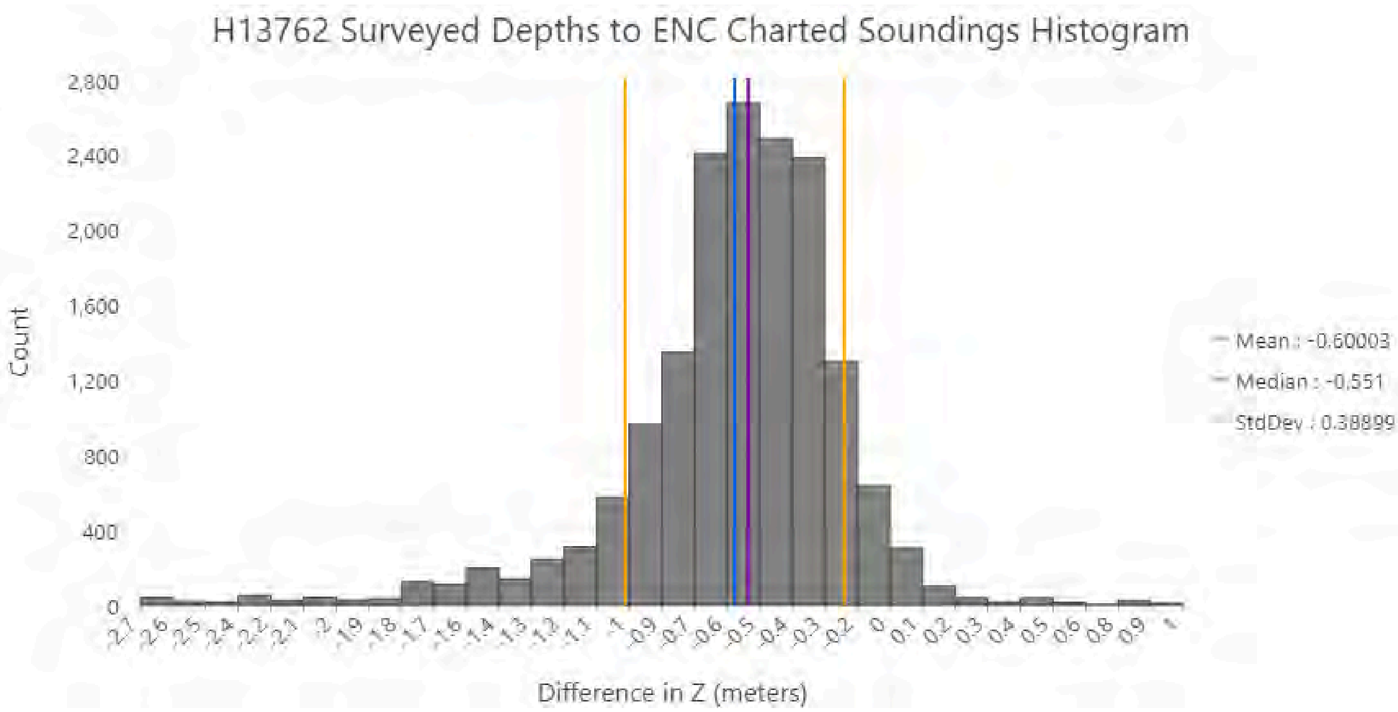


Figure 23: H13762 statistical analysis of surveyed soundings to charted soundings

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
US5NC52M	1:40000	16	10/27/2021	02/05/2024
US4NC53M	1:80000	38	08/29/2023	03/11/2024
US4NC55M	1:80000	6	09/26/2016	02/14/2018

Table 14: Largest Scale ENCs

D.1.2 Shoal and Hazardous Features

No significant shoals were identified to be hazardous in H13762. 13 DTONs were reported and forwarded to MCD and were added to the FFF with Special Feature Type as "DTON". It should be noted that the least depth, position, or feature geometry may change slightly during post-processing for reported DTONs. 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 HSD Project Manager.

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 the 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. In areas where the coverage requirements changed based on depth, disprovals were conducted at the hydrographers discretion with consideration to navigational significance and safety. Please reference correspondence for more information on disprovals for this project.

A side scan sonar contact was detected within the 150 m search radius for the assigned charted features (Unique ID: 5_001_1, 5_100_1 and 5_105_1), therefore, a disproval with 200% SSS was not conducted. The contact was developed with MBES and addressed in the FFF (Unique ID: 5_001_2 and 5_105_2). These features were changed to new obstruction areas after investigations were conducted.

Assigned obstruction with Unique ID: 5_027_1, although within the depth range for SSS coverage, was not investigated due to being outside the extents of SSS coverage requirements which are discussed in section A.4 of this report. Additionally, a disproval was not attempted for two assigned features with Unique IDs: 5_075_1 and 5_076_1 due to safety and disproval radius extending into NALL areas. Please see project correspondence for more information on disprovals.

Assigned piles with Unique IDs: 5_004_1, 5_005_1, 5_007_1, and 5_009_1 are within a new charted foul area with Unique ID: H13762_DTON_08 and were not disproved because of safety.

A disproval was attempted for two assigned charted feature (Unique ID: 5_008_1, 5_083_1), however the radius was not fully ensonified and 200% overlap was not achieved due to safety and proximity to the shoreline. These lines have been included in the respective mosaics and the feature addressed in the FFF with a description of "Retain".

In agreement with the NOAA HSD OPS, disprovals were not required for assigned charted features located within the SBES set line spacing coverage areas and these were investigated at the hydrographers discretion with navigational significance and safety in mind, and addressed with a description as "Retain" in FFF (see project correspondence).

It should be noted that Chart US5NC52M has an incorrectly charted fairway going through a shoal area. An ASSIST report was not submitted because survey data would benefit the chart update and the currently charted ATONs, Dredged Area, and charted recommended track are accurately charted and positioned. Please see Figure 24 for more details.

Side scan contacts were not included for overhead features such as powerlines and bridges as these features are charted and above the surface. These areas were properly assessed to ensure contact shadows are associated with the charted overhead feature and not new, separate features.

With respect to the aforementioned deviations, all assigned charted features within H13762 are detailed in the FFF in accordance with section 7.3 of the HSSD. See DR Appendix II Supplemental Records for related correspondence with the NOAA HSD OPS.

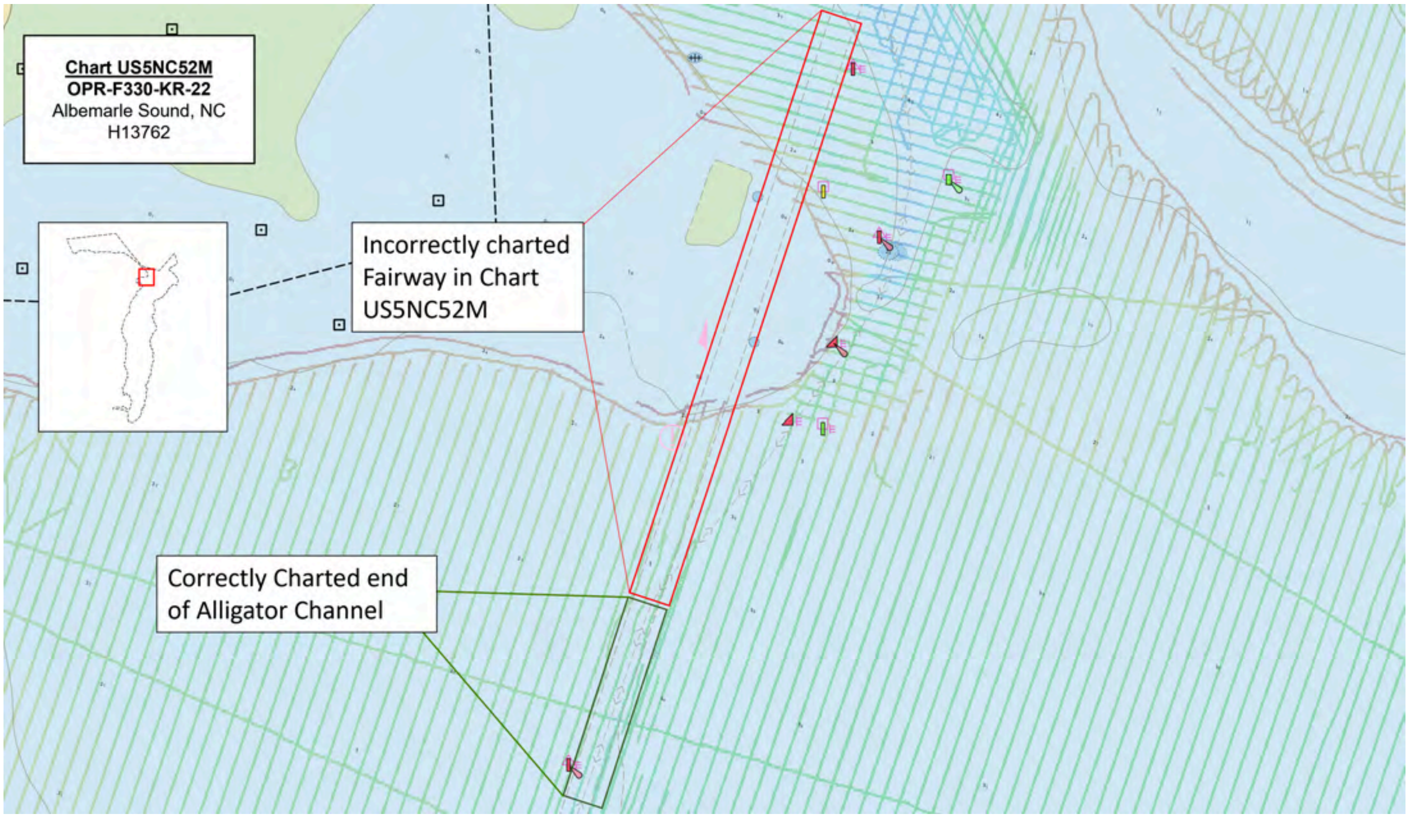


Figure 24: Image showing where the charted fairway is incorrectly positioned

D.1.4 Uncharted Features

Throughout the project area, uncharted fishing stakes and pound nets were both observed at the surface and identified in SSS and bathymetric data. In agreement with the 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.

SSS contacts with Unique IDs: CH_H13762_83_3, CH_H13762_83_4, CH_H13762_83_5, CH_H13762_83_6, CH_H13762_83_7, CH_H13762_83_8, CH_H13762_83_9, CH_H13762_83_10, CH_H13762_83_22, 4P_H13762_160_13, 4P_H13762_160_14, 4P_H13762_160_15, CH_H13762_192_1, CH_H13762_192_2, CH_H13762_192_3 were deemed unsafe to develop with MBES. These contacts are located in the FFF with the Unique IDs: H13762_DTON_09 and H13762_DTON_10. The originally submitted DTON area features were extended to include these submerged contacts, as they seem of the same origin of the fishing stakes that were visually observed above the water's surface (used to digitize the area for original DTON submission) and were unsafe to further develop with MBES.

SSS contacts with Unique IDs: CH_H13762_083_1, CH_H13762_083_2, and CH_H13762_083_21 located within the area feature with Unique ID: 5_143_1 were not developed because the contact shadows extended past the edge of the SSS imagery, relatively shallow MBES depths, and the presence of dangerous fishing stakes directly south. This feature was attributed with TECSOU "found by side scan sonar", WATLEV "unknown", QUASOU "depth unknown" due to the inability to further develop the SSS contacts with MBES.

SSS Contact (Unique ID: CH_H13762_115_6), was identified beyond the 3.5m depth boundary where SSS acquisition was not required. This contact was deemed unsafe to develop further with MBES, and is located outside the assigned sheet limits.

Six new features (Unique IDs: 5_137_1, 5_118_1, 5_121_1, 5_134_1, 5_128_1, and 5_117_1) were identified within the Intracoastal Waterway (ICW) channel that did not meet the specifications to warrant consideration as features (i.e. less than 1 m vertical), but were included in the FFF as new features due to the navigational significance of being located close to or within the channel. Please see section D.1.5 of this report for more information on channel analysis.

In agreement with the 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.

D.1.5 Channels

A comparison of the surveyed depths to the depth range value 1 attribute listed in the most up to date ENCs was conducted for all charted channels within the Alligator River in H13762.

The portion of the Intracoastal Waterway (ICW) contained within H13762 extends between Alligator River Light 10, and Alligator River Light 49. Surveyed depths within the channel were generally shoaler then the charted DRVAL1 from current ENCs, with the most significant shoaling between Alligator River Light 31 and Alligator River Light 49. Ten uncharted features were identified within or very close to the ICW, and are detailed in the FFF. Several features were found within the boundaries of the ICW which do not meet typical feature height requirements, however these are included in the FFF and the USACE Channel Analysis report as their least depth values exceeded the charted DRVAL1 value. Two DTONs identified which were within or near the ICW (Unique IDs: H13762_DTON_03, H13762_DTON_12).

An unnamed channel is present in H13762 and extends south from the ICW near Alligator River Light 39. Details on the depth comparison of this channel can be found in the Channel Analysis report.

A detailed analysis of the surveyed depths in the channels was provided to NOAA HSD OPS in accordance with section 1.6.2.1 of the HSSD. It was concluded that a separation model from LWD to MLLW was not provided and would be required for a more detailed comparison to USACE MLLW controlling depth values. Please see DR Appendix II Supplemental Records for related correspondence with NOAA HSD OPS.

D.2 Additional Results

D.2.1 Aids to Navigation

Three ATONs within the survey area were not observed during survey operations and considered missing/off-station while one ATON, associated with Alligator River Light “26”, was observed to be a red lighted buoy and therefore was mischarted on ENC US5NC52M as a BCNLAT with DAYMAR. A Local Notice to Mariners was sent out and listed the mischarted feature as either Daymark Missing or STRUCT DEST/TRLB. An ASSIST report was submitted for all four of these ATONs.

Alligator River Daybeacon 35 was not observed during survey operations. This ATON was determined to be Type 1 and a Discrepancy Report was filled out and submitted to the USCG.

Please see DR Appendix II Supplemental Records for related correspondence.

D.2.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.2.3 Bottom Samples

Two bottom samples were acquired in accordance with section 7.2.3 of the HSSD and are described completely in the FFF.

D.2.4 Overhead Features

Several features were assigned which are associated with the bridge crossing for U.S. Hwy 64 in the northern section of H13762 and are detailed in the FFF. The assigned feature with Unique ID 5_101_1 was not observed but unable to be disproved because of the presence of shoreline construction surrounding the charted LNDARE. In agreement with the NOAA HSD OPS, heights were not calculated for above water features. Figure 25 shows the charted LNDARE slightly off from the data and aerial imagery. Aerial imagery along with SSS imagery and SBES bathymetry should be used to more accurately chart the location and extent of these assigned features.

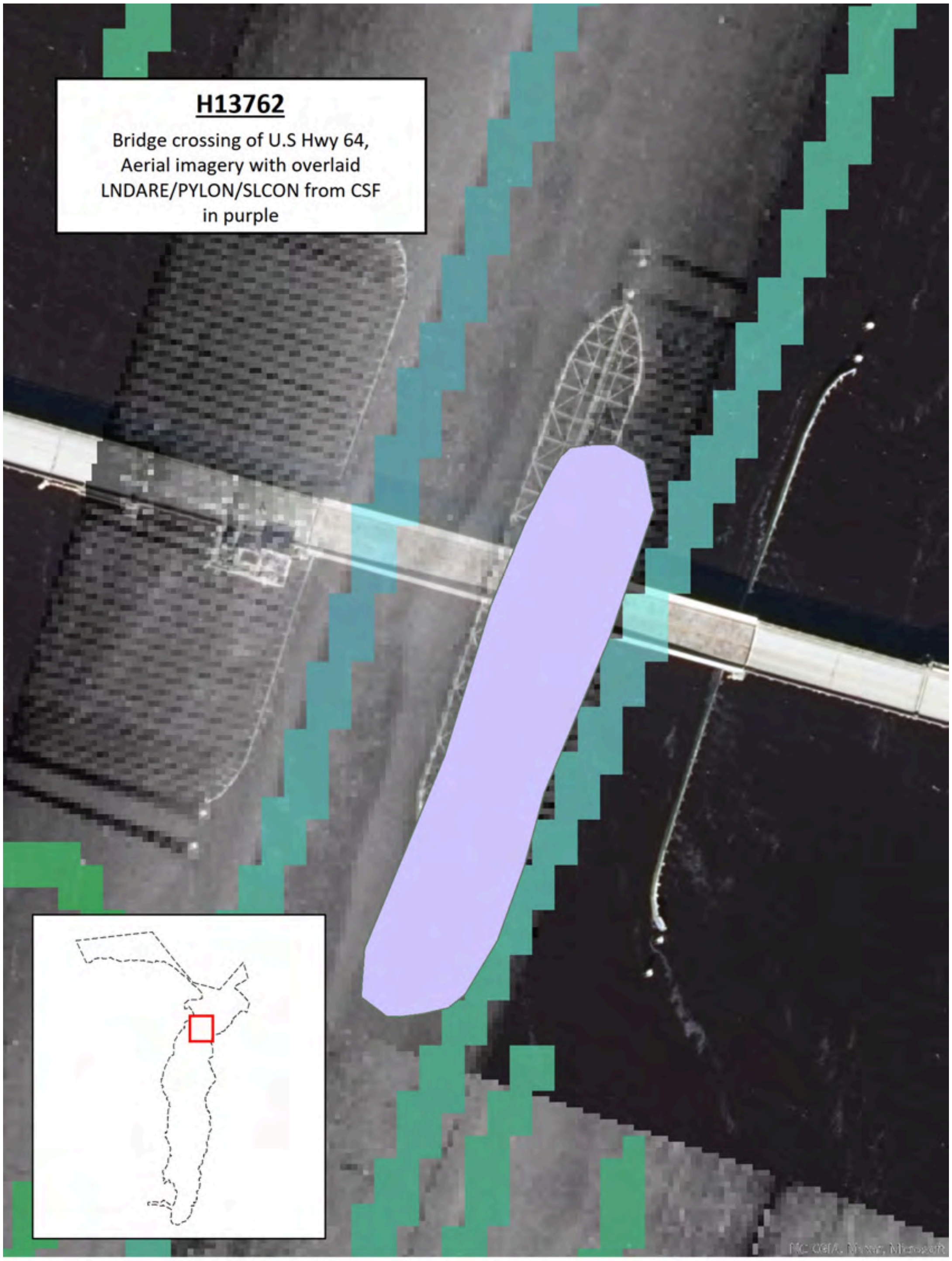


Figure 25: Bridge crossing of U.S. Highway 64, in the northern section of the Alligator River. Image shows bathymetric data (rainbow) and SSS data (greyscale)

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	Chief of Party	04/27/2024	Nicholas Damm Digitally signed by Nicholas Damm Date: 2024.04.27 12:42:49 -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